Electrical Review

THE PIONEER ELECTRICAL WEEKLY OF AMERICA.

VOL. XL. No. 4. NEW YORK, SATURDAY, JANUARY 25, 1902. ISSUED WEEKLY.

ELECTRICAL REVIEW

PARK ROW BUILDING

13-21 PARK ROW - - NEW YORK

P. O. BOX 339

BY THE

ELECTRICAL REVIEW PUBLISHING COMPANY

CHARLES W. PRICE
PRESIDENT AND TREASURER

STEPHEN H. GODDARD
SECRETARY

CHARLES T. CHILD
TECHNICAL EDITOR

RUSSELL HOWLAND
GENERAL REPRESENTATIVE

WESTERN OFFICE

1612-1613 MARQUETTE BLDG., CHICAGO

LONDON OFFICE

42 OLD BROAD STREET, LONDON, E. C.

REGISTERED CABLE ADDRESS

"ELECTVIEW" - - NEW YORK

TELEPHONE CALL, 21 "CORTLANDT"

(PRIVATE BRANCH EXCHANGE CONNECTING ALL DEPARTMENTS)

SUBSCRIPTIONS TO THE

ELECTRICAL REVIEW

One Year, United States and Canada - - - $3.00
One Year, Foreign Countries - - - - - 5.00
Single Copies, each - - - - - - - - - .10
Copies can be supplied for only one year back at 25 cents each

TO ADVERTISERS

CHANGES for advertisements should be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Monday noon to ensure publication in that week's issue.

THE SYRACUSE LIGHTING COMPANY'S STATION.

There is illustrated and described on other pages of this number one of the most interesting and well constructed lighting stations of medium size in the United States—that at Syracuse, N. Y. This station may be said to represent the fair average of good, modern practice, and to embody in different design and general method of handling practically all of the noteworthy improvements lately made in the art of electric light manufacture and sale. Indeed, this fact may well be understood from the great financial success which has attended the company's business management.

THE DINNER TO MR. MARCONI.

As reported in our issue for last week, the dinner tendered by the American Institute of Electrical Engineers to Mr. William Marconi, the inventor of wireless telegraphy, which was held last week in New York city, was a very complete success. The occasion was one not only of much pleasure to those who participated in it, but also served to make the Institute and its friends better acquainted with Mr. Marconi and his interesting personality. It is not going too far to say that few guests who have been honored by that body have made so excellent an impression upon it, both for modesty of demeanor in the face of an extraordinary exhibition of interest and applause and also for a combination of inventive ingenuity and knowledge such as is not commonly found.

One of the features of the dinner was the assemblage together at a single table of a number of men who have done more for the advancement of civilization through engineering works than perhaps any other equal number of men who have ever lived contemporaneously. The names of William Stanley, Alexander Graham Bell, Michael Pupin, Elihu Thomson, Frank J. Sprague and of William Marconi himself, represent contributions to engineering achievement, including the invention, exploitation and perfection of the electric railway, the electric light, the telephone and wireless telegraphy, that rank with the very greatest that have been made. And singularly enough, none of these men is old.

No notice of this occasion would be complete without reference to the extraordinarily successful work of the committee on arrangements, who, in the short space of three days, carried through the details of this interesting occasion with the utmost success. The Institute is to be felicitated upon this very interesting and successful evening's entertainment, and upon its ability to gather together so interesting a party of guests at such short notice.

THE NEW YORK CENTRAL RAILROAD'S TERMINAL PROBLEM.

After a meeting of the board of directors of the New York Central & Hudson River Railroad, which was held in New York last week, announcement was made of the perfection of the company's plans for the installation of electric traction in the Grand Central Station terminal in New York and the approaches leading thereto.

The solution adopted is probably the best, all circumstances considered, that could be devised. In brief it consists in using two of the four tracks, leading through the long tunnel forming the approach to this station, exclusively for the service of long-distance express trains operated by steam locomotives, continuing in this way the service as it has been in operation. These trains, however, constitute only a small proportion of the numerical total of trains using the tunnel and approaches. It is proposed to use the other two tracks for the suburban trains of all kinds, and to operate all of the latter service by electricity upon a loop-terminal system, the loops being constructed underground below the level of the present station. By reason of this loop arrangement, through which all trains enter the station on one track and leave it on the other, crossing over from one to the other by one or more loop tracks, about fifty per cent more suburban trains can safely be operated than are at present handled. The alteration involves naturally a very considerable expenditure and the grant of a number of rights from the city and state authorities. These, it is believed, can be had without difficulty. Already an increase in the capital stock of the railroad company to the amount of $35,000,000 has been ordered by the directors, this stock being expected to sell at about 125. While, of course, the whole of this vast amount of money will not be necessary for the electrification of the suburban system it is believed that doubtless a large

part of it will be used for extensions of the electrical system beyond the limits suggested in the statement above.

This is one of the most important steps in electric traction that has ever been taken. The aggregate total of suburban service using the Grand Central terminal in New York city is probably as large as that of any other terminal in the world. While the conditions impose some difficulties, yet there is nothing involved in the engineering details of the problem which will require research or extended experiment. The equipment of the long-distance express trains will probably follow that of the local and suburban service trains as a matter of course.

THE METRIC SYSTEM.

It is stated that a meeting has been called by a number of prominent manufacturers and engineers to consider steps whereby the metric system may be more thoroughly exploited in this country and to report upon the general advisability of extending this system.

The United States and England occupy a peculiar position in regard to this system, and one that puts them at a possible disadvantage with their competitors in the general markets of the world by reason of their adherence to a system of weights and measures which is peculiar unto themselves.

The metric system is in general use throughout the continent of Europe and in most other civilized countries of the world except those speaking English. In the latter countries it is used in scientific work and to some degree in manufacture, but the whole bulk of its use forms an entirely inconsiderable proportion of the general total. The metric system was legalized in the United States some time ago, and is in use in the scientific and technical bureaus of the government. There seems to be, however, some inherent difficult in the way of making it acceptable to the bulk of American and English manufacturers and commercial people.

The difficulty is twofold. In the first place, one of the strongest characteristics of the Anglo-Saxon race is its conservatism. It dislikes a change. It took more than sixty years for the decimal system of coinage in use in the United States entirely to supplant in popular favor the British system which had preceded it. To this day in certain parts of the United States the various coins are named after the shillings and pence system which obtained here before the revolutionary war. But this is not all. The units of the metric system, while singularly satisfactory for scientific and laboratory use, are as singularly unsatisfactory for practical every-day purposes of business and manufacture. The metre is too large and the centimetre is too small a unit for the machine shop or the ordinary factory. The decimal subdivision and multiplication of these units, while admirable in some respects, appears not to lend itself at all to the formulation of correctly graded systems of screw-threads, drills, reamers, etc., and even in Germany today, where the metric system is entirely at home, the Whitworth screw gauge is in use and the centimetre is divided into quarters and eighths for certain manufacturing purposes.

Another, and perhaps scarcely less important, difficulty in the way of the metric system is the uncouth and foreign names of the units. Our tongues do not take kindly to such words as kilometre and decigramme. For all of these reasons it seems that the metric system still has a long and somewhat hard road to travel in these United States, despite the kindly assistance which Congressman Southard and others are giving it.

THE DANGERS OF ELECTRIC TRACTION.

No little interest has been elicited in engineering and railway circles by the recent publication of a communication to the New York *Times* from Mr. George Westinghouse concerning some dangers which are present in electric traction. To sum up Mr. Westinghouse's views, the possibility of higher speeds from electric traction, while not extending the vision of the engineer in charge of the apparatus, will necessitate a greater distance within which to stop trains. Again, the distribution of a great weight of apparatus beneath one or more cars of a train, more or less loosely supported, with a small clearance above the rails and road-bed, requires a greater degree of precaution than is the case with present steam cars. Further, a short-circuit is sufficient instantly to set fire to wooden cars and when a total wreck results from accidents, which are inevitable with any mode of traction, the debris scattered about over live and running rails would invite further and serious accidents. On account of these considerations, and especially when the system under consideration is installed in a tunnel, Mr. Westinghouse has uttered a note of warning.

It would be an unworthy member of the engineering profession who would attempt to stand in the way of the introduction of the most scientific, serviceable and reliable safety appliances for any purpose. The dangers to which Mr. Westinghouse calls attention certainly exist, although it is doubtful whether they exist in such marked degree as to render precaution against them more important than that against certain other dangers which surround every variety of transportation, whether by land or sea. The inflammability of cars is a subject upon which much has been said and written. In the not remote past there have been dreadful accidents upon steam-operated railways in which cars were set afire by lamps or stoves or by the locomotives themselves. Several years ago the Legislature of the State of New York, and subsequently those of other states, passed laws requiring the suppression of the car stove and of the car lamp in the interests of public safety. Perhaps if manufacturing had then been advanced to its present point they might have gone a step further and suppressed the wooden car. No one can fail to agree with Mr. Westinghouse that fireproof cars are very desirable and that electric traction systems should be surrounded by every apparatus of safety.

It is to be hoped, however, that this warning, emanating as it does from so distinguished an engineer, and one so identified with the progress of electrical engineering in this country as to rank among the first in the list of productive agencies in the electrical field, should be misinterpreted into any attack upon electric traction systems. This, indeed, he has explicitly denied. Coming at this time his communication may seem to give to those opposed to the extension of electric railway traction a valid argument against such a system. The contrary is true, because, from the very nature of the suggestions made by Mr. Westinghouse, the remedy for all of the dangers mentioned in his remarks is clearly shown.

THE THEORY OF ALTERNATING DYNAMO ELECTRIC MECHANISMS—LIII.

BY W. ELWELL GOLDSBOROUGH.

At the time of closing the circuit, suppose the external, variable, non-inductive resistance to have a value r_1, and that the constant armature resistance has a value r_a, and the constant armature inductance a value x_a; then, by equation (54), the effective value of the current will be

$$I = \frac{E_0}{\sqrt{(r_a + r_1)^2 + x^2_a}} \qquad (54)$$

which we can represent by the vector OB lagging

$$\phi_0 = \tan^{-1} \frac{x_a}{r_a + x_1} \qquad (55)$$

degrees behind OA_0. This armature current, by virtue of the inductance of the armature coils, will produce a magnetic field, in phase with itself. This field we represent by the vector M_0M, drawn parallel to the current vector from the positive extremity of OM_0.

The cyclic magnetization set up by the armature current develops a counter electro-motive force OD_a, lagging 90° behind the current, and there is also a loss of effective electro-motive force due to the armature resistance that is represented by the short electro motive-force vector OC_a in phase with OB; therefore, the total loss of electro-motive force in the armature will be the resultant of the two vectors OD_a and OC_a, which is OA_a. The effective electro-motive force that overcomes the resistance of the non-inductive external circuit is the vector A_aA_0, since it completes the electro-motive-force triangle on OA_0, and is in phase with the current OB.

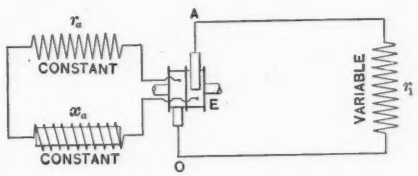


FIG. 132.—ALTERNATING MECHANISMS.

The total effective electro-motive force OC_0, that overcomes the total resistance, $r_a + r_1$, is due to the cyclic magnetization that is the resultant of the fields represented by OM_0 and M_0M. This is the magnetic field OM, which, as shown by the geometry of the figure, is 90° in advance of the current, and, therefore, of OC_0 and A_aA_0, as it should be. At this point, a fact is worthy of emphasis. The vector, OM_0, is proportional to the pole flux penetrating one armature coil, and, therefore, proportional to the electro-motive force developed in a coil when the machine is running on open circuit. The vector, OM, is proportional to the resultant flux enclosed by an armature coil when the armature is running on closed circuit; therefore, when the armature is on open circuit, its insulation is subjected to a stress that is proportional to the vector, OM_0, but when it is operated on closed circuit, its insulation is subjected to an electro-motive force that is proportional to the resultant flux vector, OM.

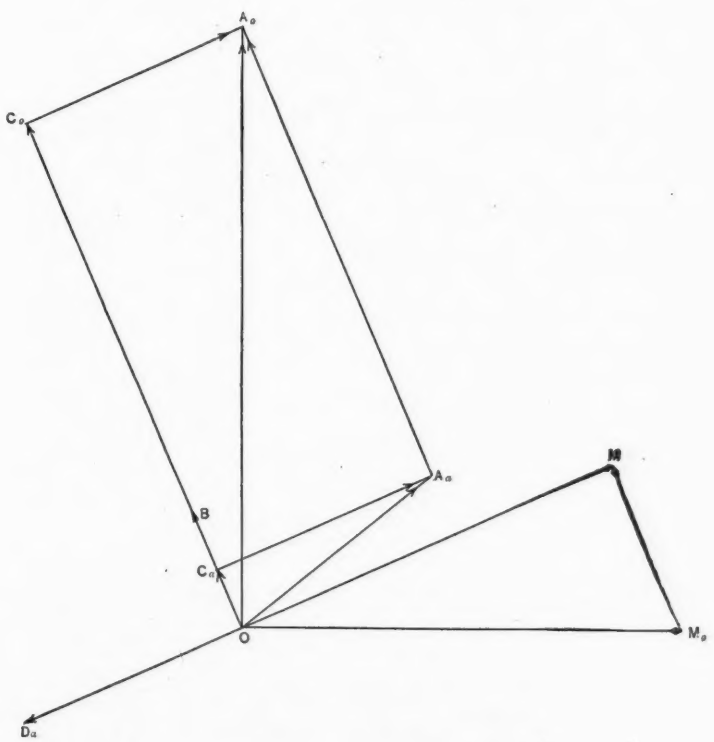


FIG. 133.—ALTERNATING MECHANISMS.

In the present case, the difference in the lengths of the vectors, OM_0 and OM, is slight. Under proper conditions, however, the lengths of these vectors may vary in magnitude greatly, and it is well to have in mind the fact that the insulation resistance of the armature must be sufficient to withstand the electro-motive force developed by the flux, OM, a variable, rather than that of the electro-motive force developed by the flux, OM_0, (practically) a constant.

In Fig. 133 we have all the prominent factors present which modify the working of alternators. When a machine is working on open circuit, as has been pointed out, OA_0 is the electro-motive force at the collector rings, and we may mentally assume that this electro-motive force is always present in the armature coils so long as the field excitation remains constant. This assumption makes the mental picture of the reactions which take place as the machine is operated much clearer than if we attempt to analyze the problem on the basis of the maximum actual potential developed in the coils. The latter, represented by the vector, OC_0, is equal, under present conditions, to the maximum electro-motive force in phase with the current.

New York Electrical Society.

The combination of science and audacity which characterizes much of the long-distance transmission work done during the last few years in California was strikingly brought out at the 220th meeting of the New York Electrical Society, held January 15, by Dr. F. A. C. Perrine, who lectured on "The Power Plants of the Pacific Coast." Dr. Perrine said that one of the objects of his lecture was to show the men in the East that the far Westerners were no mere rough and tumble engineers, and it was generally admitted that this point was abundantly proved. A more wonderful series of pictures of brilliant engineering triumphs than that thrown on the screen by Dr. Perrine has seldom been presented to a scientific audience. Dr. Perrine is at any time able to speak with authority on this subject, but his remarks were especially valuable from the fact that he has recently made an extensive trip through California and the far West for the particular purpose of investigating the situation of power-transmission work there.

Science Brevities

Sparking in Dielectrics—In April last Signori Broca and Turchini described some experiments which enabled them to observe disruptive discharges in highly conducting electrolytes. M. H. Bagard now describes a general method of producing sparks in electrolytes in a simple and certain manner without having recourse to the great resources of the former authors, says one of Mr. Fournier d'Albe's abstracts. He reduces the exposed surface of the electrodes to a small amount by using thin wires cased in ebonite up to near their ends. To produce the discharge the author uses two Leyden jars, whose internal armatures are joined to an influence machine and to the two branches of an exciter immersed in a liquid. This liquid maintains by its conductivity the equality of the potentials of the two armatures as long as the charge is comparatively slow. But if the exciter is adjusted for a sufficiently high spark potential, as soon as there is a discharge of the internal armatures, the sudden discharge which tends to take place between the external armature can not take place by simple electrolytic conduction, and a spark breaks across the dielectric.

Electric Resistance Crucible—In a paper read before the American Institute of Mining Engineers, at their Mexican meeting, Professor H. M. Howe, of Columbia University, described a simple form of electric resistance magnesia crucible for laboratory work. The device consists of a crucible of pure magnesia, surrounded with a spiral of platinum wire, and fixed in a cavity shaped to fit in a large block of magnesia. Another block of magnesia forms the cover to the furnace. The furnace has been in use for some months without giving trouble, and temperatures as high as 1,400 degrees centigrade have been attained without injury to the platinum spiral. The apparatus is said to be particularly convenient when it is desired to maintain a high temperature constant for long periods.

Terrestrial Magnetism at Great Elevations—The question as to how far an elevation above sea-level influences the magnetic elements can not at present be decided by balloon observations, and recourse must, therefore, be had to observations on mountains. Such observations are often vitiated by disturbances due to the mountains themselves, and it is only when those disturbances are eliminated that trustworthy results can be arrived at, says the *Electrician*. A successful set of measurements in this direction has been made on the Righi by two Dutch physicists, Heeren van Rijckevorsel and van Bemmelen. Preliminary observations made in 1895 showed that the plateau of the Righi itself could be regarded as a non-magnetic. This valuable result was confirmed by measurements taken at nineteen stations distributed round the Righi in two circles. Measurements were also taken at thirteen other stations lying on a circle at a greater distance from the Righi, as well as at Brienz and at Zurich. On the basis of these measurements the authors made a determination of the influence of elevation upon the magnetic elements, and they conclude that that influence is negligible.

Electrical Transport of Fluid in Capillary Tubes—In spite of the popularity of frictional and induction electric machines, we do not hear much of good work on static electricity. One should have thought, for instance, that the following observation by Semlin Lemström, well known through his researches on atmospheric electricity and auroral displays, would have been recorded long ago, says *Engineering*. He published a preliminary note three years ago; a fuller account has now appeared in the *Annalen der Physik*. A beaker, half filled with water, is placed on a zinc plate; a strip of tin-foil reaches from the water over to the zinc. In the water stands a capillary tube, one-half millimetre in bore. Over this tube, in the continuation of its axis, is held a copper needle, point downward, encased in an ebonite tube. The apparatus is connected with a Wimshurst machine of modified construction, and Leyden jars and other parts are added. There is always an air-gap, sometimes of great width, between the water in the capillary and the needle point. When the positive current travels from the water to the point which is connected to the negative terminal, water is carried up the capillary, so that a series of drops ascends in the tube, ebbing away again under the influence of gravity. This transport is still visible when the point is seventy-five centimetres (about thirty inches) above the water. When the poles are reversed, no ascension of water is noticed, but some formation of drops is still discernible. The upper part of the capillary is examined with the aid of a microscope. The quantity of water transported is proportional to the current intensity, measured in a spark micrometer, and also to the time during which the current acts; this latter proportionality holds, however, only for a few moments owing to the opposing effect of gravity. When all earth connections of the machine or apparatus are interrupted the meniscus remain stationary. Salt solutions are also transported, but the bulk is smaller than in the case of water. This transport of material particles was studied by Herr G. Quincke in 1861, and seems to have been neglected since. The capillary currents may play a part in the supposed influence of atmospheric electricity on the growth of plants. In former experiments, Lemström had covered experimental beds with wire netting. These experiments have now been taken up again, and the wire nets are fitted with needles, pointing downward.

Plan to Adopt Metric System.

Representative Southard (Rep.), of Ohio, chairman of the House Committee on Coinage, is about to send invitations to a number of the chief manufacturers, merchants and others engaged in mercantile pursuits to appear before the committee on February 6 for the consideration of the bill to adopt the metric system of weights and measures.

Heretofore Congress has secured the views of scientific men on this subject, but Mr. Southard holds that such a change in the entire system of weights and measures is a practical question on which the large business interests should be heard. Among those to be invited are Vice-President W. M. McFarland, of the Westinghouse Electric Company; Superintendent Vauclain, of the Baldwin Locomotive Works; the electrical experts of several large concerns, and the officers of a number of large woolen and textile industries.

Merchants' Association Meeting.

The annual meeting of members of the Merchants' Association, of New York, was held on January 14. Five directors of the board of fifteen were elected to succeed those whose terms expired at that time, and three directors were elected to fill vacancies caused by resignation. The newly elected directors are Mr. George F. Crane, of Baring, Magoun & Company; Adolph Openhym, of William Openhym & Sons; George L. Duval, of Beeche, Duval & Company, each to succeed himself, and Mr. George Frederick Vietor, of Vietor & Achelis, to succeed Mr. Albah Trowbridge, and Herbert L. Satterlee to succeed Hon. John H. Starin.

Exports of domestic products from the United States for the calendar year 1901 were $863,800,883, an increase over 1900 of $31,450,000.

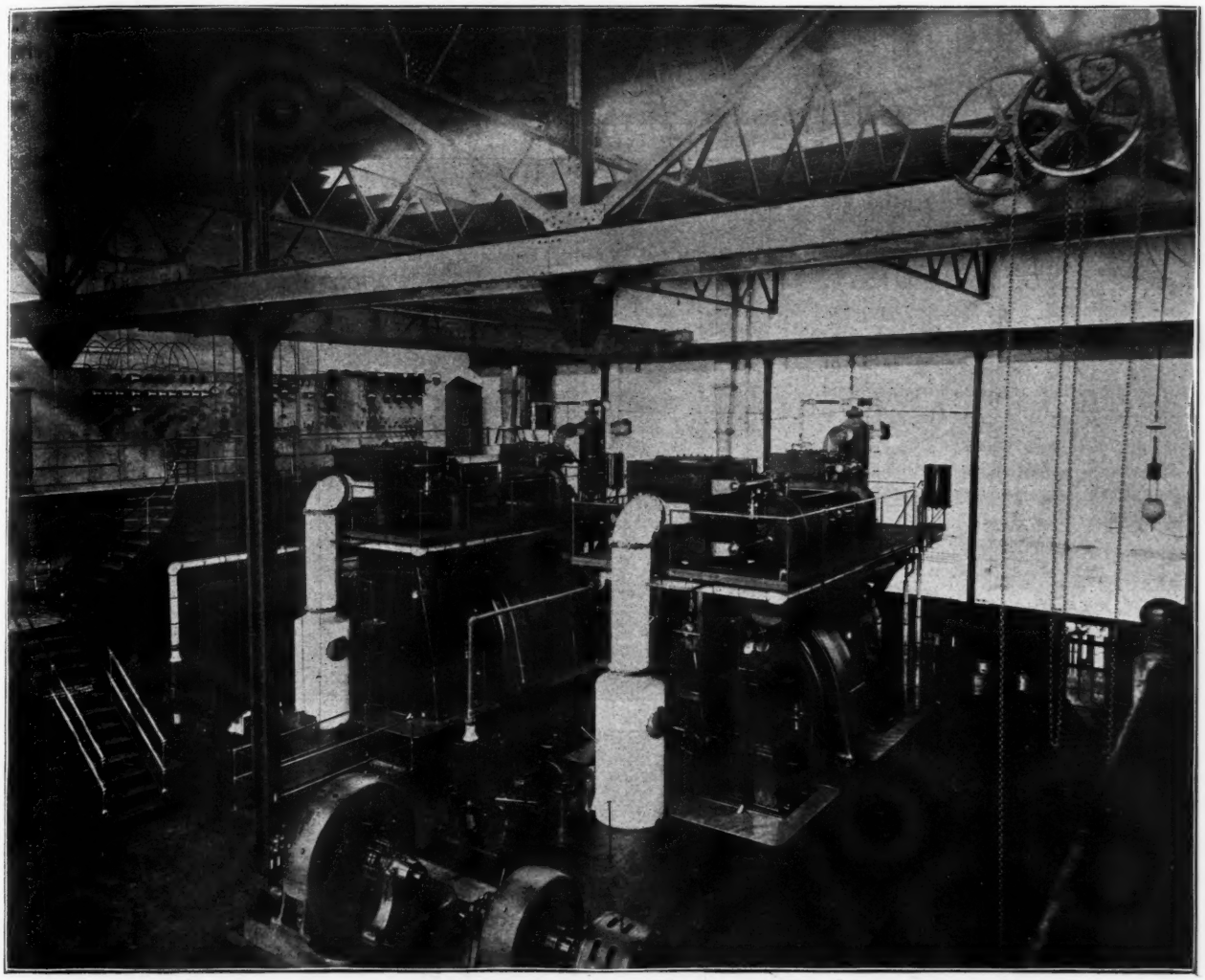
The Central Station of the Syracuse Lighting Company.

A Description of a Model Plant of Intermediate Size.

THE CITY OF SYRACUSE is situated in the lake region of Western New York and is built on one side of the Erie Canal. The plot of the city and the arrangement of its business centre, surrounded by residential districts with outlying suburbs, is unusually compact. For some years past the Syracuse Lighting Company has furnished electrical energy for light and power purposes in a district including the city and its immediate surroundings and has constructed, as the outgrowth of past installations, one of the most interesting and well designed central stations of an intermediate size to be found in the United States.

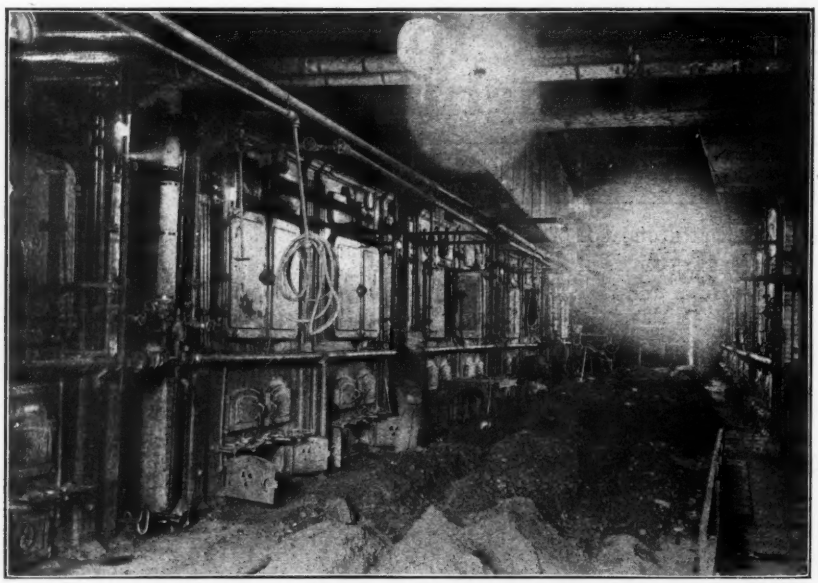
The station stands upon the bank of the Erie Canal at a distance of perhaps half a mile from the centre of distribution for light and power and is so situated that it has also convenient delivery for coal by railway as well as unusual facilities for the reception of fuel from boats on the canal. As is well known the Erie Canal is closed to navigation for about four months during the winter each year and during this time the station is dependent upon railway delivery of coal or else upon the large store of that fuel accumulated near-by.

The station building is of brick of a generally rectangular shape and comprises, besides the installation of engines and generating machinery, repair works, shops, testing rooms, storerooms, offices and a large supply of coal. The boiler room is located immediately between the canal and railway sidings and while at present fuel is brought in in carts it is planned immediately to install a conveyor system working from either end toward the middle so as easily to handle coal from boats or from railway cars.



GENERAL VIEW OF VERTICAL ENGINE UNITS, SWITCHBOARD, AND EXCITER UNIT, SYRACUSE LIGHTING COMPANY.

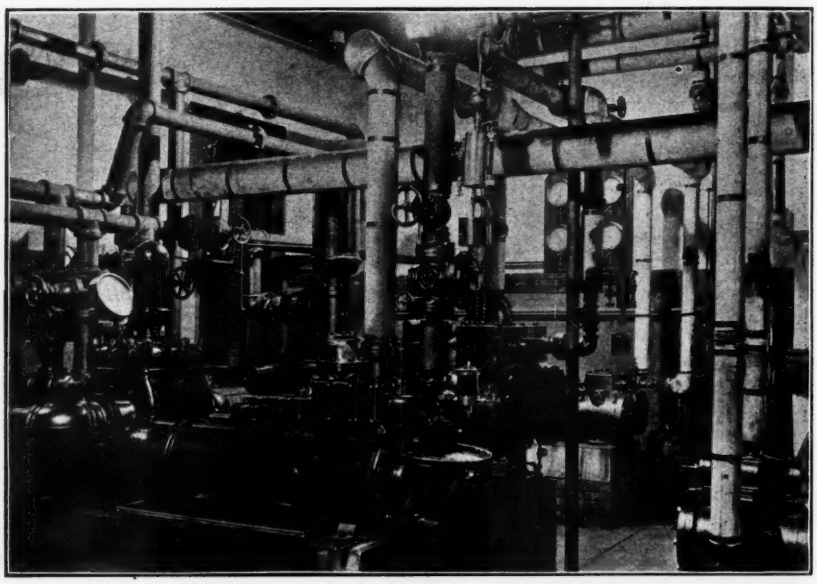
The motive-power equipment is entirely of the steam-operated type. The boiler room contains eighteen return tubular boilers set in brick, each being six feet in diameter by seventeen feet long, all of the up-takes being piped together to a brick smokestack 200 feet high and having a round flue nine feet in diameter.



THE BOILER ROOM.

Hand firing is used. The general appearance of the boiler room may easily be seen from one of the accompanying illustrations, which gives an excellent idea of its arrangement. The water used for boiler feed purposes at Syracuse contains considerable quantity of salts in solution, for which purpose an ingenious system of preheating and separation is used, the hot filters being shown in the accompanying illustration. In this apparatus the feed water is heated by live steam to a high temperature, under pressure, causing it to deposit such matters as are in solution in filter beds of charcoal and gravel contained in the vertical filtering tanks well shown in the illustration. An installation of pumps of the Blake type receives the feed water from these filters and passes it to the boilers. The illustration showing the pump room clearly exhibits the method of placing and installing these pumps. Both the pumps and the filters occupy separate rooms in a space between the boiler and engine rooms, and, indeed, the station throughout is well divided so as to secure the maximum of reliability of action of all of its parts.

The main engine room contains an interesting variety of apparatus. The steam-driven units consist of three McIntosh & Seymour vertical compound engines, two of these units being coupled directly with 600-kilowatt, 3-phase, 60-cycle, 2,400-volt alternators of the General Electric type, and one of them to a single-phase alternator of the same capacity and frequency. In addition to these units

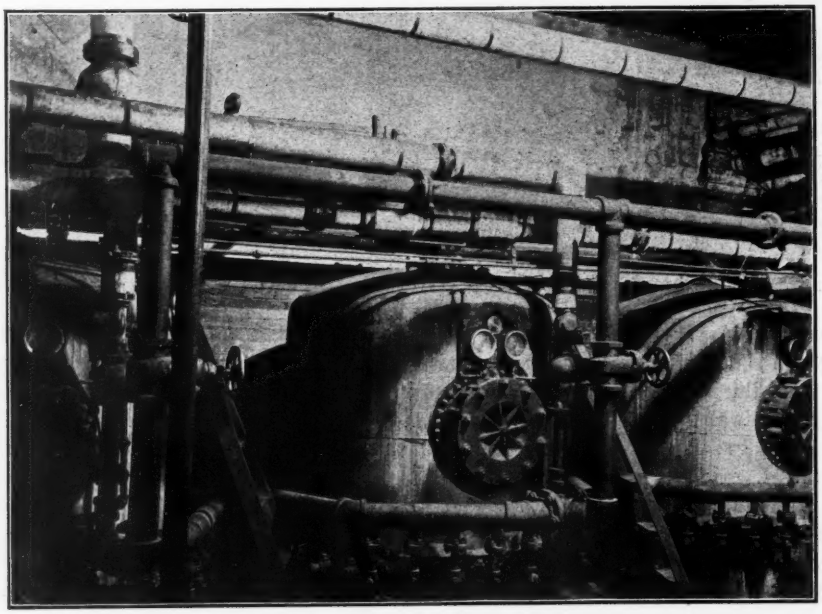


THE PUMP ROOM.

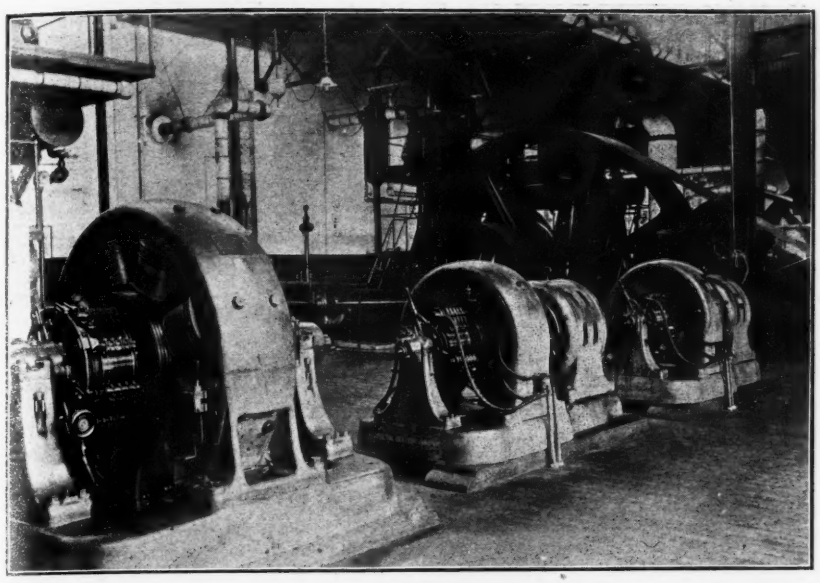
there is a McIntosh & Seymour horizontal cross-compound engine of 1,500 horse-power direct-coupled with an 850-kilowatt direct-current generator and two engines of the Allis type, one of 500 horse-power and one of 1,000 horse-power, belted through a countershaft to a group of arc generators. Near the vertical polyphase units are installed two exciters, each of fifty kilowatts capacity, direct-coupled to synchronous motors. Near these stands a 200-kilowatt, 500-volt rotary converter.

The engines are provided with air pumps and condensers of the Blake type and Chapman valves are used throughout the steam fittings. Auxiliary heaters of the Goubert type are also installed for utilizing, as far as possible, the heat of the exhaust in warming the feed water.

Syracuse is a manufacturing city and furnishes a large market for power. The



LIVE STEAM PURIFIERS AND FILTERS, SYRACUSE LIGHTING STATION.

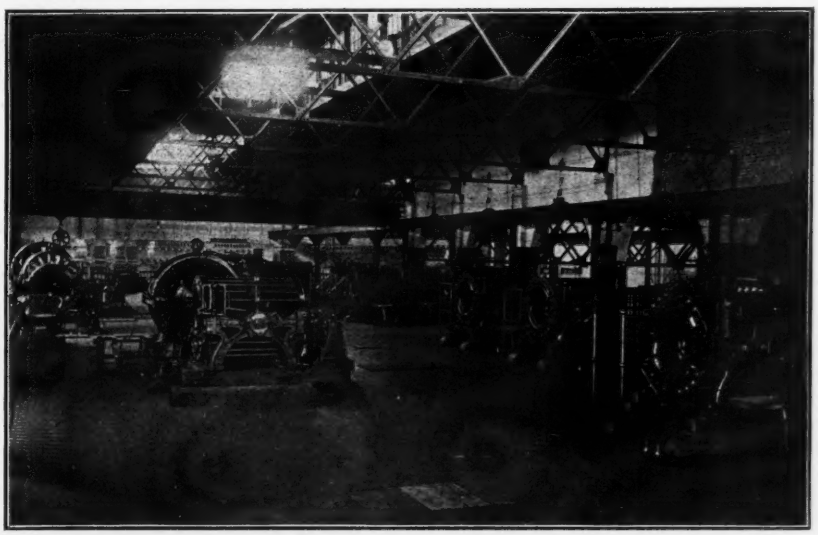


Rotary Converters and Exciter Units, Syracuse Station.

company has an output of no less than 1,800 horse-power in motors, these being mostly operated on the 500-volt direct-current circuit, although a few single-phase and polyphase motors are also in use. In general, lighting is accomplished from the different phases of the three-phase supply, the mains being operated at 2,300 volts from the station and the current appropriately transformed by means of transformers located in manholes in the section of the city in which underground wiring is mandatory. This section embraces a considerable area in the business centre of the town, but does not include the central station itself, from which the feeders pass overhead to points on the outskirts of the underground district.

Arc lighting is done by means of direct-current apparatus, the General Electric type of lamp being in use throughout the city. For generating the direct current for this purpose there are installed twenty-three 50-light General Electric machines and two Brush, 125-light arc machines, current being furnished at 9.6 amperes. In all there are in use for street illumination no less than 1,350 series arc lamps of nominal 2,000 candle-power. Connected with the company's general distribution system are the equivalent of 95,000 sixteen-candle-power incandescent lamps.

The main switchboard, which is shown in one of the illustrations, is of an exceedingly simple type, all of the apparatus for the control of the arc circuits being placed at the left-hand end, the apparatus for controlling the outgoing high-pressure alternating feeders being in the middle and the direct-current apparatus at the other end. The switchboard is mounted in a gallery giving a comprehensive view of the main engine-room, which is a large and lofty apartment well lighted and ventilated, as can be seen from the larger illustrations.



Group of Arc Lighting Machines, Syracuse Station.

In the Test Room, Syracuse Lighting Station.

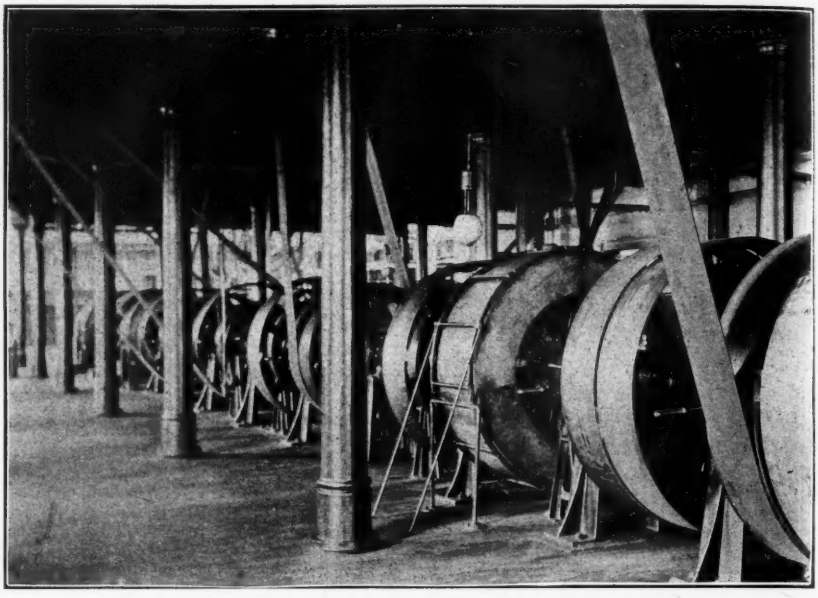
The arc apparatus is operated from a large countershaft shown in one of the smaller engravings, the arc generator-room being at a different level from the main floor of the station and separated from the larger engine-room by a brick wall. This also is shown in some detail in one of the smaller engravings.

One of the features of the work of this company is that its entire activities are, so to speak, self-contained. It maintains its own repair and supply department and also a testing-room in which very careful measurements are made upon meters,

lamps, etc. Photometry also forms an important part of the work conducted in this branch of the establishment. One of the illustrations gives a general view of one end of the testing-room, showing banks of meters under test.

All of the output of the company, except that used for street lighting, which is contracted for by the municipality at a fixed annual price, is sold to consumers by meters. No less than 4,500 meters have been installed in various premises in Syracuse, these being of the Stanley and General Electric types. Charge for current is made on the basis of a fixed sum per kilowatt-hour with discounts for large users. The company makes its own lamp renewals and very carefully inspects and standardizes the lamps supplied to customers.

It is interesting to note that this fine installation under the excellent management which has characterized it is a paying institution, its stockholders having received regularly a comfortable dividend, while a large surplus account is carried against depreciation, repairs, renewals and extensions. Mr. J. J. Cummins is vice-president and treasurer, and Mr. E. B. Doen is superintendent of the company.

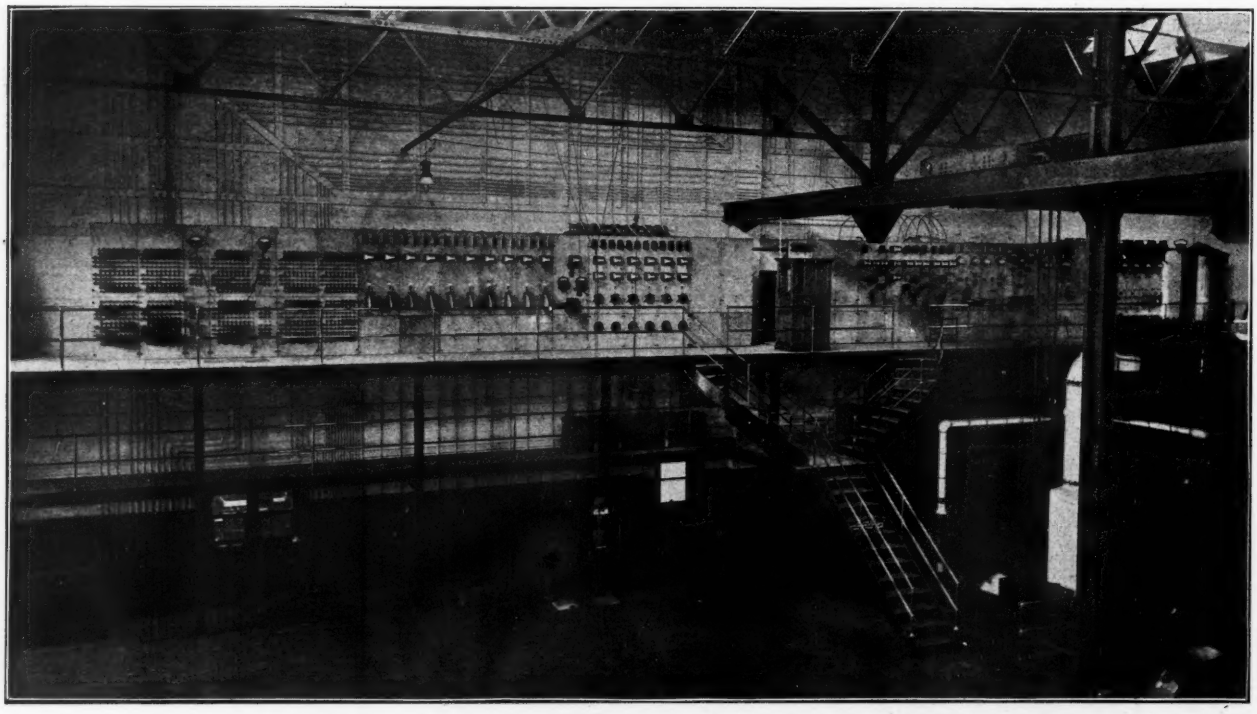


Countershaft for Arc Dynamos, Syracuse Station.

According to the *Aluminum World,* aluminum is an exceptionally useful ingredient in yellow brass, provided but little tin is present. It makes the metal run more freely, and enables much cleaner and sounder castings to be made. The best brass-founders are accustomed to use aluminum for all cheap yellow brass work that is to be used for sand castings; it is not a desirable ingredient in brass intended for rolling.

Theft of Telephone Wires in Europe.

Cable thieves have been busy on the Continent of late, the most recent case reported being from Sweden, where telephonic communication between Stockholm and the Swedish provinces has been seriously interrupted. The cause of the stoppage remained a mystery until the workmen sent out to look for faults discovered that whole lengths of copper wire had been removed. The sagacity of the thieves is evidenced by the fact that the iron wires were not touched, and this fact has led to the belief that the miscreants must be looked for among the employés of the administration itself, as no other persons are credited with being able to discriminate between the iron and copper wires at nighttime. New wires have now been laid, and a reward offered for the apprehension of the thieves.



The Main Switchboard in the Syracuse Lighting Company's Central Station.

"The Telegraph System of Brazil" is the subject of an interesting report to the state department by Thomas C. Dawson, secretary of the United States Legation at Rio de Janeiro. The substance of his remarks is to the end that the government operation is not profitable in Brazil.

The Northwestern Electrical Association Convention.

The Tenth Annual Gathering of This Vigorous Electrical Society, at Milwaukee, Wis., January 15, 16 and 17, 1902.

THE TENTH annual convention of the Northwestern Electrical Association, which was held at Milwaukee, Wis., last week, was one of the most interesting and important in the history of that body. The Northwestern association has for years enjoyed the reputation of being active and vigorous and of prosecuting strenuously the interests of its members and of the fraternity at large. Its meetings are also characterized by an abundant good fellowship and generally by some more or less important papers and discussions. This meeting was no exception to the general rule.

The first day's session was called to order at noon, January 15, in the clubroom of the Hotel Pfister, Mr. E. L. Dobell, the president of the association, being in the chair. The short session was taken up by formal announcements and an adjournment taken until 2 P. M.

Upon reassembling at this hour the president read his address. He said:

To-day marks the opening of the tenth annual convention of our association, and I bespeak your united efforts to make it a profitable and pleasant one. Although the first annual meeting of the association, under its present corporate style, was held in this city in February, 1893, the Northwestern Electric Light Association, as we were up to that time known, had held prior meetings in Oconto and Oshkosh, and, I believe, in Waupaca also, so that our association is really somewhat older than ten years.

During this period our members have steadily increased, and I hope we may say our work has progressed with the times. A few of our members have passed away, but many more have come to take their places. In our gatherings many warm friendships have been begun and cemented. The meeting with our fellow workers, and the discussions of our every-day work and problems, is of great value, or should be so, to us all.

The exchange of ideas and the knowledge gained of superior methods of conducting our business can not fail to benefit us if thoughtfully received and considered. Constant changes and improvements are being made in the equipment of electrical properties, and vast sums of money are yearly spent for the reconstruction of plants that were new and up to date a few years ago. It is entirely likely that some of this money could be saved, or made more productive, if investors would first seek and obtain the experience of those who have already made similar changes. The services of competent engineers are, of course, necessary, but oftentimes no advice is so good as that of a friend who has been through the mill.

A principal value of our association is the opportunity for the exchange of information useful to its members, not alone through the reading and discussion of papers, but by personal and familiar meeting between members. A number of valuable and interesting papers will be read and discussed at this convention, and I solicit your careful attention to them. They deal with subjects and problems that come before us in our daily work, and can not fail to be of benefit to us all.

The work of our Legislative Committee for the past year has been confined to the state of Wisconsin, where very strong efforts were necessary to prevent the enactment of numerous laws adverse to our interests. These efforts have been entirely successful and reflect much credit on the committee.

I take this occasion to impress upon all Wisconsin central stations the necessity of greater support and cooperation in this important work. Every company in the state should share in the necessary expense and work, and also become members of this association in order to ensure complete cooperation and harmony. It has been necessary each year to send representatives to our state capital to defend our interests, and while the successful results have been enjoyed by all alike, the labor and expense have been borne by a few. I hope in the future to see a marked change in this condition.

At the conclusion of the address the report of the secretary-treasurer was read by Mr. Thomas R. Mercein. This report showed the affairs of the association to be in excellent condition and spoke particularly of the work of the committee on legislation, which will be described more fully below.

After the appointment of a number of committees several new members were elected.

Professor Dugald C. Jackson then read the report of the Committee on Correspondence Schools. This committee was formed for the purpose of calling the attention of correspondence schools to the class of instruction given students who are anxious to enter some branch of the central station industry. Professor Jackson reported that the committee's efforts had met excellent success, and that two of the largest of the correspondence schools had altered their course of instruction so as to bring it up to date and more nearly in conformity with the demands and requirements of the employers of their students.

The report of the Legislative Committee was then read by former Governor Upham, of Wisconsin, its chairman. Governor Upham said that whereas about forty-two bills inimical to electrical interests had been introduced in the state legislature during the year past, only one of these had passed, and that bill no human being could understand.

The meeting being thrown open for general business, Mr. Gille made an earnest plea for uniformity in the size of advertising literature sent out by manufacturers. He said that he had on file in his office no less than thirty-eight different sizes of advertising matter to which he wished to refer from time to time.

A committee was appointed to report concerning the advisability of holding a summer meeting. Mr. Barron seconded Mr. Gille's remarks concerning uniformity of size, and went a little further in suggesting that the electrical journals also consider the same thing. Mr. Bowen, of Kenosha, said that he had adopted a well-known system of filing such matter and had had no trouble with it whatever. Mr. George Cutter said the matter was interesting to him because much time and hard thought were expended on the preparation of advertising matter, and it was of great importance that this should be presented in such shape as to make it available for the purpose for which it was intended. After some further discussion a committee of three was appointed to recommend some standard size and form of advertising matter to be sent to central stations. A long discussion ensued regarding the advisability of appointing a committee of three in each state in regard to legislative interests of electric light companies. A motion finally prevailed to appoint a general committee consisting of three members from each state, the chairman of this committee being from Wisconsin.

At this point Mr. O. M. Rau, of Mil-

waukee, read his paper, entitled "Reconstructing or Modernizing Central Stations." This will be found in full elsewhere in this issue. The paper was discussed by Mr. Gille, Mr. Bowen, Mr. Pearce, Mr. Korst, Mr. Almert, Mr. Schott and the author. Considerable laughter was elicited by Mr. Gille's statement that no isolated plant could possibly exist in a town where the electric light management was of the proper kind.

Mr. Van Rensselaer Lansingh, of Chicago, then read a long paper, entitled "The Best Use of Electric Lights for Desirable Illumination." Mr. Lansingh's paper dwelt very fully with the subject of illumination in general and of the effect of shades of all kinds upon the distribution of light from incandescent and arc lamps. His paper included a strong argument in favor of the Holophane globe.

After hearing Mr. Lansingh's paper the association adjourned until the next morning. In the evening a theatre party, which was largely attended, was given to the members and guests present.

THURSDAY, JANUARY 16.

The afternoon session was called to order promptly by President Debell, who announced the appointment of a number of committees.

"Questions and Answers" formed the subject of the earlier part of the proceedings. Mr. Gille enquired concerning the progress recently made in placing the Nernst lamp on the market. Professor D. C. Jackson, replying, stated that the lamps he had had in service gave a very satisfactory and beautiful light. He had not had the lamps in operation long enough to tell anything about their economy and life. No trouble whatever had been experienced with any of the lamps during the period they had been operated. A few glowers had been replaced, but it had not been found necessary yet to clean the lamp shades. He estimated two hundred hours as the period during which these lamps had burned. The starting devices seemed reliable. He had understood that the company making the lamps preferred the 220-volt type as the more economical.

Mr. Gille related his experience with the lamps and said that with the multiple glower type he had some difficulty in getting all the glowers started at once. The discussion became general regarding minutiæ of construction of commercial types of Nernst lamp. Mr. Harding said that he had burned a three-glower lamp something over a thousand hours, and had had the same difficulty, in that some of the glowers did not start properly. This was due, in his opinion, to mechanical imperfection in the lamp, which he thought would soon be remedied. Mr. Bowen was anxious to know regarding the maintenance of the lamps. He said: "The general tendency of central station practice is toward individual ownership of all appliances. It is well enough for a supply house to sell a man any device, but the central station after that is interested in the thing because it has to maintain it." He cited the Welsbach light as a parallel case. In this lamp the customer makes his own maintenance alterations by putting in new mantles when this is necessary. In some stations the station managers take care, for example, of enclosed arc lamps, trimming them, cleaning them, etc.

Mr. Harding said that he had been furnishing his customers lamps at cost and was prepared to maintain them himself. He thought that the result would be a less expense per unit of light than with the enclosed arc.

The next order of business was the report of the committee on the summer meeting. The report recommended that the association meet at the Grand View Hotel, at the "Chain o' Lakes," Waupaca, Wis., on June 25, 26 and 27, 1902. After considerable discussion on the subject of the summer meeting and the time when it should be held, the report of the committee was accepted.

Mr. E. J. King then read a paper entitled "Some Important Points in the Commercial Measurement of Electrical Energy." Mr. King's paper discussed a number of features of electric meters from the standpoint both of the consumer and of the central station. He spoke of the tendency on the part of meter makers to eliminate constants from all sizes of integrating meters so as to make these instruments read directly in kilowatt-hours. This has generally been done by changing the gearing of the counting mechanism. He felt that the losses due to incorrect registration of meters present a problem of the most vital importance. Careful attention to calibration of meters in service can not be too strongly urged. The paper was discussed by Mr. Gille, Professor Jackson, Mr. Korst, Mr. H. C. Wirt, Mr. Allen, Mr. Bowen, the president and others.

Mr. Wirt then read his paper, entitled "Modern Transformers." Mr. Wirt's paper covered the whole subject of recent improvements in transformers, both in design and methods of construction. He entered at length, with many illustrations and data, into the important questions of core loss, general overall efficiency, regulation and the subject of testing transformers and their insulation against high voltage. At the conclusion of the paper a vote of thanks was unanimously given Mr. Wirt.

The president presented to the association Mr. Henry L. Doherty, of Denver, Col., president of the National Electric Light Association. Mr. Doherty made an interesting address on the subject of the National Electric Light Association and its work. He spoke particularly of its strong stand against the growing tendency toward municipal ownership. Another work that the National association has been carrying on is the investigation of arc lamp photometry, in which the association and its engineers have done fundamental work of high importance. At the conclusion of Mr. Doherty's remarks a recess was taken until 2 P. M.

In the afternoon the first order of business was the reception of the report of Nominating Committee, which was as follows:

For president, Irving P. Lord, of Waupaca, Wis.

First vice-president, E. H. Korst, of Janesville, Wis.

Second vice-president, George D. Westover, of Cadillac, Mich.

Secretary and treasurer, Thomas R. Mercein, of Milwaukee, Wis.

Directors, F. W. Bowen, A. M. Barron, E. C. Hay.

The usual formal election was held, the secretary casting the unanimous ballot of the association for the nominees.

The new president and officers were escorted to the platform, and President Lord made a brief address. He recited the history of the growth of the association, and requested the outgoing president, Mr. Debell, to preside during the remainder of the session.

Professor Warren S. Johnson, of Milwaukee, was then presented to exhibit to the association a new system of wireless telegraphy. Professor Johnson gave a short account of the history of wireless telegraphy and certain electrical theories involved in its exploitation. He described the apparatus in use by Mr. Marconi and others, and also Popoff's experiments. He then described the experiments conducted by Mr. Fortier and himself. In the apparatus exhibited compressed air is used to release the coherer. Professor Johnson held up some of Mr. Marconi's results to mild ridicule. He did not think that cable stocks would be greatly affected

by the success of the transatlantic experiment. Mr. H. C. Wirt made a strong address in reference to the value and importance of Mr. Marconi's work.

The next business on the programme was a paper by Mr. H. H. Hornsby, of Chicago, entitled "Inspection and Hazards of Modern Plants." Mr. Hornsby's paper was long and very interesting. It dealt with the subject of insurance and company inspection, and with the policy to be observed in each with reference to securing the best results. He spoke of the improvements that had been made in apparatus and supplies during the last four or five years. He made a large number of exhibits of apparatus and parts showing the effects of electrical accidents. He made a strong argument for the provision of absolute protection against accident and fire and for the propagation of new rules by the National Board of Fire Underwriters.

Mr. W. A. Layman, of St. Louis, then read a paper, entitled "High Power-Factor System of Arc Lighting." Mr. Layman's paper was a description of a system of series arc lighting of alternating current using a balanced and automatically adjusted reactive coil in series with the lamps. It also included a comparison of this variety of apparatus with that employing a constant-current transformer with a variable magnetic circuit. The discussion was general but short, being confined to a number of questions and answers.

At the request of Mr. Doherty, members were invited to state what they thought was the most interesting problem now before the electrical profession in this country, their replies to be used in guiding the National Electric Association in formulating its programme. The replies were various and covered such subjects as methods of extending the business of stations, lightning and protection against it, and the revisal of underwriters' rules. Mr. Greer spoke of the importance of illuminated signs as a method of increasing station business. Mr. Wirt thought the single-phase alternating-current motor would be a large factor in improving the day load of stations. This suggestion precipitated quite a little discussion, in the course of which Mr. Layman described a small station in Illinois in which a ninety-kilowatt single-phase generator works forty-five horse-power of single-phase motors during the daytime; one of these motors is of thirty horse-power, and is used to drive a clay-crushing plant, which is very severe service. The discussion then turned to the subject of the gasoline Welsbach light. It seemed to be generally understood that people would not bother with oil lighting and the danger of gasoline was fatal to the success of this apparatus.

Thursday evening, at 8.15, the members of the association assembled in the club-rooms and repaired to the banquet hall on an upper floor. One hundred guests sat down together and an evening of rare entertainment followed. Secretary Mercein was toastmaster, and most happily did he discharge his duties. His felicitous remarks, many times during the evening, brought forth bursts of applause from the merry banqueters. President Irving P. Lord was first speaker and took occasion again to thank the association for the honor conferred on him, while he promised to lend his best efforts to strengthening the association. He also promised that the summer meeting at Grand View Hotel, near Waupaca, June 26, 27 and 28, was going to be an event in which he was greatly interested, and he gave each member a "tip" not to miss this session, as there would be good times for all. The gentlemen present seemed to be of one accord that if Irving P. Lord said they should have a good time, it was bound to be so, and all resolved to be there.

Mr. Wilmer Sieg, president of the Business Men's League, of Milwaukee, and Mayor David S. Rose, made speeches of welcome, and thanks to the association for honoring Milwaukee with its presence. Both of these gentlemen are graceful and accomplished speakers and contributed much to the success of the banquet.

The toastmaster then announced that he would do away with formality and called upon the following gentlemen during the evening, who responded with much wit and humor: Messrs. Henry L. Dougherty, H. G. Underwood, George S. Whyte, George Cadwell, Frank L. Perry, George Cutter, George S. Searing and W. J. Ellis, of the Milwaukee Press Club. At 2 A. M. the revels ended, and the tenth annual convention of the Northwestern Electrical Association was consigned to history by the guests in chorus, accompanied by the orchestra, singing "Auld Lang Syne."

The meeting was one of the best that the association has ever had. On Friday morning a small amount of unfinished business was taken up and completed, after which the final adjournment was taken.

CONVENTION NOTES.

On the parlor floor of the Hotel Pfister a number of firms opened headquarters and entertained the members of the association and visitors. Among the concerns represented were the following:

The Fort Wayne Electric Works, represented by Messrs. Walter S. Goll, W. C. Knight and E. J. King.

Bryan-Marsh Company, New York, represented by Messrs. C. D. Marsh, president; Geo. C. Keech, E. H. Houghton, L. P. Sawyer, G. V. Williams, R. N. Young.

Illinois Electric Company, Chicago, represented by L. K. Cushing, C. W. Bacon and a big bowl of "Illinois punch."

Sawyer-Man Electric Company, New York, represented by Mr. Percy S. Gibson.

Westinghouse Electric Company, Pittsburgh, represented by Messrs. W. R. Pinckard, Thos. James and C. G. Burton.

Viscosity Oil Company, Chicago, represented by Messrs. S. A. Johnson, president; Frank Travers and J. C. Blackford.

Dearborn Drug and Chemical Works, Chicago, represented by J. W. Harkins, E. T. Ward and P. H. Early.

General Electric Company represented by Messrs. R. A. Swain, O. E. Turner, S. F. Dibble, F. G. Vaughen, H. C. Wirt and Thos. Ferris.

Reliable Electrical Supply Company, Chicago, represented by Walter C. McKinlock.

Goltz Engineering Company, Chicago, represented by Mr. William Goltz.

Kuhlman Electric Company, Elkhart, Ind., represented by Mr. E. Kuhlman.

Electric Appliance Company, Chicago, represented by Mr. W. P. Upham and J. B. McMullin.

Federal Electric Company, Chicago, represented by Mr. James M. Gilchrist.

M. B. Austin & Company, Chicago, represented by Messrs. A. H. Friend and A. Meinema.

Dayton Fan and Motor Works, Dayton, Ohio, represented by Mr. E. H. Belden.

Holophane Glass Company represented by Messrs. Van Rensselaer Lansingh and A. A. Ernst.

Electrical Supply Company, of Madison, Wis., represented by L. W. Burch.

Columbia Incandescent Lamp Company, St. Louis, represented by Mr. Cole.

Julius Andrae & Sons Company, Milwaukee, represented by F. T. Andrae, J. C. Schmidtbauer and H. P. Andrae.

Professor W. F. M. Goss has recently reported a case which shows how great may be the difference in the efficiency of different firemen. In a test of a pumping engine extending over seventy-two hours, the boilers were fired by different firemen, each working a "watch" of eight hours. The load on the engine and other conditions were practically constant throughout the run, yet the worst fireman used twenty-five per cent more fuel during his watches than the best one did.

Carbon Anodes for Industrial Electrolysis.

An interesting note on the use of carbon anodes in the electrolytic production of alkali and bleach has been contributed to the *Zeitschrift für Angewandte Chimie* by Mr. F. Foerster, says *Engineering*. It is true that platinum free from ruthenium is now obtainable commercially, and that the consequent production of sheets of platinum-iridium 0.20 inch square and a few thousandths of an inch thick, has rendered anodes of this alloy available for many purposes. Nevertheless, such anodes are still too costly for use in the electrolysis of salt solutions for the manufacture of chloride and soda. For this purpose carbon anodes have to be employed, although experience has shown that, strictly speaking, such anodes are in no sense unattackable by the electrolyte. Such anodes are made either of coke, retort carbon, or lampblack. Occasional pieces of retort carbon are large enough to permit of anodes being cut from them, but the usual plan is to make the electrodes in another way. The coke or retort carbon is powdered, and after mixing with coal tar is moulded to shape, and then baked at the highest possible temperature. If lampblack is used as the raw material, a quite similar method is followed. The electrodes thus produced differ much in physical characteristics, some being much harder and denser than others; while in some cases the imperfect carbonization of the tar leaves the anode little better than a mass of amorphous carbon. In any case, it is incorrect to class the carbons thus produced as graphites, although true graphite can be produced artificially, as at the Acheson Works, Niagara. Using graphite and moulded carbon anodes of different makes for the electrolysis of a salt solution, it was found that while the graphite specimen showed least waste, its record was closely approached by the best of the moulded carbons, though others made a much less favorable showing. The waste arises in the main from actual oxidation of the carbon, though, at the same time, there is a constant loss from disaggregation, which is less the denser and less porous the carbon. When sulphuric acid was used as the electrolytic, ninety-five per cent of the energy expended is wasted in the destruction of the carbon, and with this electrolyte there is little difference in the resisting powers of all forms of carbon tried. All carbon electrodes are porous, and differ thus materially from metallic electrodes. To get the best results with carbon electrodes, theory and experiment agree in recommending the use of a high current density, though contrary opinion is not uncommon.

Submarine Cable Faults.

A fault which was removed a short while ago in the Eastern Extension Telegraph Company's cable between Sydney, N. S. W., and Nelson, have brought to light an interesting fact in connection with the interruptions occurring in submarine telegraph cables. In the case in question the fault was discovered in a part of the cable at a depth of 330 fathoms, where was found a tooth firmly fixed in the core of the cable, although the core was protected by the usual sheathing of thick iron wires and outer coverings. On examination it was proved that the tooth belonged to a species of shark, the exact variety of which could not be identified.

The Foyers Aluminum Works.

In a paper recently read before the Glasgow local section of the Institution of Electrical Engineers, Mr. W. M. Morrison gave some interesting particulars of the aluminum works at Foyers. The River Foyers, he stated, had a catchment area of 100 square miles. To equalize the supply two lochs have been joined by raising dams and embankments, so as to form a single loch between five and six miles long by one-half mile wide. The storage capacity thus provided is sufficient to run the entire plant at the factory for fifty days and nights, this reserve being ample in all but the driest seasons. The conduit to the power-house is a tunnel eight and one-half feet in diameter, and the available fall is 350 feet. The principal plant consists of seven Girard turbines, each connected to vertical continuous-current low-pressure dynamos of 700 electrical horse-power each, running at 150 revolutions per minute. For the class of work on which these machines are employed no governors are necessary, as hand regulation suffices. The load-factor, allowing for stoppages, spare power, etc., is from 0.9 to 0.95. Two smaller turbines supplying the electric light and driving machinery are also provided, and these are fitted with hydraulic relay governors. Mr. Murray states that, so far, aluminum is in practice reduced from its oxide, in spite of the fact that were it commercially possible to use the chloride or the sulphide as the electrolyte, there would be a great saving of power. Up till the present, however, the chemical operations necessary for the preparation of aluminum chloride or sulphide have proved too difficult and expensive; but should these be substantially improved, a considerable saving in the cost of producing aluminum should result. The voltage needed to decompose the different compounds is as follows: Aluminum fluoride, 4.0 volts; oxide, 2.8 volts; chloride, 2.3 volts, and sulphide, 0.9 volt. With the oxide the oxygen combines with the carbon of the anode to form CO, which is burnt to the dioxide in the air. As illustrating the extraordinary tenacity of the film of oxide with which aluminum covers itself when exposed to the air, Mr. Morrison said that if in casting the metal, an excess runs over the side of the mould, the film on the overflow is so strong that it acts as if it were a rigid tube, and unless broken it may siphon out a considerable quantity of metal from the mould.

Experiments on Bronze.

The Verein Deutscher Ingenieure recently instituted a series of experiments with a view to determine at what temperature bronze is reliable in engine construction. For the purpose of the tests twenty-five bronze rods were supplied from the Imperial Dockyard, at Kiel, 8.66 inches in length and 0.48672 square inch in section, and composed of ninety-one parts copper, four parts zinc and five parts tin. A set of five rods of similar dimensions and composition gave the following average: Breaking weight per square inch, 8.47 tons; elongation at moment of rupture, 36.7 per cent on 7.874 inches; decrease in sectional area, 47.4 per cent at a temperature of twenty degrees centigrade (sixty-eight degrees Fahrenheit). The results are summarized as follows, taking the results obtained at a temperature of sixty-eight degrees Fahrenheit as unity:

Relative values at:

	212° F.	392° F.	572° F.	752° F.	932° F.
Breaking strain.....	1.01	0.94	0.57	0.26	0.18
Elongation.....	0.98	0.96	0.32	....	....
Decrease in section...	0.91	0.93	0.31	....	....

From this it is evident that bronze of the composition here experimented on may safely be employed for valve seats, pipes, etc., at a temperature of from 392 degrees Fahrenheit to 572 degrees Fahrenheit, but not above.

Aluminate of barium, a compound formed by the action of heavy spar on bauxite, is said to be an admirable agent for the purification of feed-water. It is readily soluble, but added to water containing either sulphates or carbonates of lime a double decomposition takes place, an insoluble aluminate of calcium being produced together with insoluble sulphates or carbonates of barium. The precipitate, which is flocculent, settles readily and takes down with it at the same time any organic impurities suspended in the water. The compound is said to be now used for feed softening in some French and Belgium works.

THE CONSTRUCTION OF SMALL TELEPHONE EXCHANGES—XXIV.

BY A. E. DOBBS.

SELECTIVE SIGNALING — HARMONIC SYSTEMS.

In the last chapter we spoke of signaling by means of intermittent currents of different polarities. These systems seem to have proved quite reliable in practice and while it is possible, by combining the two wires, to get six subscribers on one circuit, yet, in practice, four is considered the only simple and reliable combination. This, however, brings us to three more classes:

1. Currents of different strength, by means of which one ringer will respond only to a weak current, while the other will respond only to a strong current.

While this system has been used to a certain extent in duplex telegraphy where there are expert operators to adjust the instruments whenever necessary, the system has so far proved too delicate and complicated to find any extended use in the telephone field.

With the central battery systems, now so common in towns of even small size, it is possible to so adjust battery strength that it may yet be found useful. For all that, however, it is advisable to keep all central office equipment as simple as possible.

2. Tuned or harmonic systems.

Prior to 1876 Professor Elisha Grey worked out a system of tuned relays for use in telegraphic work, by means of which he managed to send as many as eighty different telegraph messages over one wire at the same time. His method consisted in tuning a number of reeds, similar to the steel tongues of a music box, rigidly fastened at one end, leaving the other free to vibrate.

These tongues would only respond to frequencies of a certain rate of vibration per second and any armature not so adjusted would not respond to this rate, or, if it did, would not respond with sufficient force to close its contact.

This led to the invention of the musical telephone, an apparatus that preceded the speaking instrument. While this would seem an easy solution of selective signaling, yet there seems to have been quite a number of practical difficulties to overcome, for though the Patent Office was flooded with systems of this sort twenty years ago they have never been applied to any extended use.

The trouble from these systems probably arose from the fact that the tongues would not stay tuned, as changes in temperature would put them out, the change from thirty-two degrees to ninety degrees, for example, being considerably greater than most people suppose. Then two vibrations sent rapidly over a line possessing considerable static capacity have a tendency to change their wave form, lag and run together, which might produce interference of signals.

Then two vibrations on a certain fundamental note have a tendency to also produce vibrations in other tongues tuned to its third, fifth and octave, and this also applies to electrical waves.

In the ELECTRICAL REVIEW of November 2, page 552, is shown a system somewhat different from the above which can be attached to the ordinary alternating-current generators of the exchange and which is here reproduced as Fig. 104.

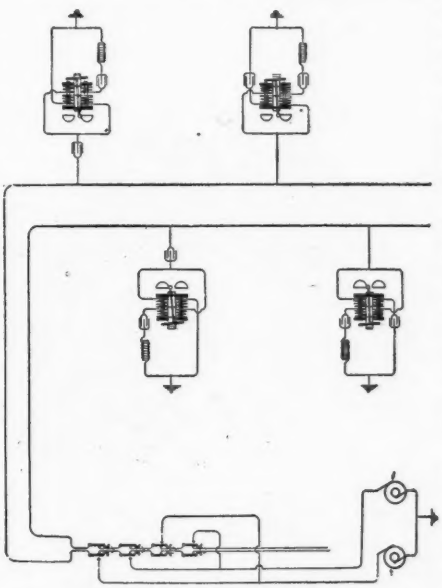


FIG. 104.—A FOUR-PARTY LINE SELECTIVE SYSTEM.

In the lower right-hand corner are shown two alternating generators running at different speeds so that one will have a frequency of sixteen and the other twenty-six cycles (alternations) per second. The metallic circuit line is divided into two parts, with two ringers on each side, one so adjusted by means of its condensers and choke coil that it will respond to sixteen and the other to twenty-six cycles, the talking circuit being omitted for the sake of simplicity.

But to quote from the article:

One of the low-frequency ringer windings is in circuit with a condenser and a choke coil which are so proportioned that they will neutralize at a frequency of twenty-six cycles per second. A high-frequency current will divide equally through both of the windings of the low-frequency bell and not ring it; but a low-frequency current is stopped by the high impedance offered thereto by the condenser in circuit of one of the windings so that the greater portion of the current will flow through the remaining winding and thus operate the low-frequency bell.

In the high-frequency bell one winding of the two differential windings is again included in circuit, with a condenser and a choking coil, proportioned to neutralize at the high frequency (twenty-six cycles per second), while the other winding is included in circuit with a condenser. As the impedance offered by the condensers which are in circuit with the two windings of the high-frequency bell to the flow of the low-frequency current is very great, this low-frequency current will divide equally through both windings and not operate the bell, as the impedance of the choke coil is very small at this frequency (sixteen cycles per second). The high-frequency current will flow readily through the winding included in circuit with the condenser, and the choke coil as the capacity and impedance neutralize on this frequency; the flow of this current through the other winding is greatly impeded, however, by the condenser in circuit therewith, so that this high-frequency current divides through the two windings with sufficient inequality to operate the bell.

The system seems comparatively simple and practical enough to come into quite an extended use unless it develops faults that do not appear at present.

The great trouble with many selective ringing devices is that they require special batteries, generators or ringing keys so that they have to be placed in a section of the board by themselves and under the care of an operator who knows how to use them. This defect the system just described seems to minimize to a great extent, but it still requires the use of four ringing keys or buttons in each cord circuit.

American Institute of Electrical Engineers.

The 160th meeting of the Institute was held at the house of the American Society of Mechanical Engineers, New York, on Friday evening, January 24. Dr. Cary T. Hutchinson, of New York, presented a paper on "The Relation of Energy and Motor Capacity to Schedule Speed in the Moving of Trains by Electricity."

The United States output of coal now exceeds that of Great Britain, which country up to two years ago was the largest producer in the world, and the total of all grades will be 275,000,000 net tons this year.

There are now some thirty electric furnaces operating in Italy, mostly near Terni and Narni, Perugia, for the manufacture of calcium carbide.

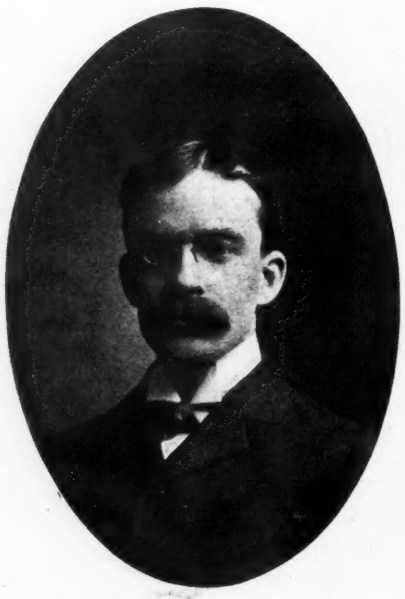
Professor Goldsborough Chief of the Department of Electricity of the St. Louis Exposition.

Professor Winder Elwell Goldsborough, professor of electrical engineering and director of the School of Electrical Engineering of Purdue University, has just been appointed chief of the Department of Electricity of the Louisiana Purchase Exposition, to be held in St. Louis during the summer of 1903.

Professor Goldsborough was born in Baltimore, Md., October 10, 1871. At the age of eight years he went to China with his parents, his father having been appointed American consul at Amoy, China. Young Goldsborough lived in China seven years, visiting nearly every section of the empire, and also going outside to travel through Japan and Hindostan. Then he returned to the United States, and in 1889 entered Cornell University. In 1892 he was graduated from that institution with the degree of M. E. A little later he took charge of the electrical work of the International Correspondence Schools at Scranton, Pa. In March he was made professor of electrical engineering at Arkansas University, Fayetteville, Ark. Just a year later he was called to Purdue University to take the position of associate professor of electrical engineering there. In 1896 he was made full professor, and in 1897 was elected director of electrical engineering for the university, a position he still holds. Soon after he became connected with Purdue University Professor Goldsborough made a series of tests at the Platt street station of the Edison Electrical Illuminating Company at Baltimore, and the valuable results obtained were embodied in the reconstruction of the plant. His report was published in the *Transactions* of the American Institute of Electrical Engineers. The committee which passed upon that paper reported that the scope, conduct and results of the tests were ideal in their proportions.

Since that time he has been engaged, in addition to his regular university duties, in professional consulting electrical engineering work, involving the drawing of plans and specifications for lighting and power plants, the designing of electrical machinery for manufacturing companies and a large variety of expert work upon various types of electrical machinery, appliances and stations. He has given extended attention to expositions, beginning with the Columbian Exposition. He was a member of the international electrical congress at Chicago, and was present at all the electrical gatherings at the Omaha and Buffalo expositions, and served as a juror of awards at the latter. He was appointed one of the delegates of the American Institute of Electrical Engineers to the Paris Exposition in 1900, and now holds the office of manager in this organization. He is a member of numerous engineering and scientific societies, among which may be mentioned the American Institute of Electrical Engineers, the Institution of Electrical Engineers of England, the Franklin Institute, the American Association for the Advancement of Sciences, and the Society for the Promotion of Engineering Education.

He is a member of the committee on arc lamp photometry of the National Electric Light Association, and under his direction a large amount of experimental work on arc lamps and arc lamp carbons has been done in the electrical laboratories at Purdue during the last two years. He is also chairman of the committee on the magnetic qualities of iron and steel of the international association for testing materials.



WINDER ELWELL GOLDSBOROUGH.

He is the author of numerous papers appearing in the electrical and scientific press, and has contributed largely to the transactions of the American Institute of Electrical Engineers, the National Electric Light Association and other technical societies.

Professor Goldsborough has long been known also as a contributor to the electrical journals, his work in the ELECTRICAL REVIEW having attracted particular notice and attention.

PATENTS FOR THE YEAR 1901.

BY E. G. SIGGERS.

During the past year many electrical devices have passed through the United States Patent Office, with the result that thousands of inventors, or their assignees, in this art alone, have monopolies for seventeen years on the results of their fertile brains.

Many of these inventions have been described in the ELECTRICAL REVIEW, and it has been evidently the aim to include only those along distinctly novel lines, or those that would be of the greatest interest to readers. It is only natural that among the multitude many important and useful devices have been overlooked, and on the other hand, perhaps, some of an unimportant nature have appeared, for in this art, like every other, all sorts and conditions are brought forward and "crank" inventors are plenty.

It would be impossible to ascertain the exact number of electrical patents issued during the past year without going through the entire number, which is considerably over 25,000, exclusive of design patents on peculiarly-shaped parts of machines and the like. Then the fact that electricity enters into so many other arts, would practically preclude an examination of this kind. For instance, a hasty glance through the index for the first week of the year reveals forty-one patents, the titles of which clearly indicate that they belong to electricity. Yet there are probably as many more which could only be discovered by an examination of the 599 patents issued in the week, and this is only one of fifty-two weeks. Naturally, among so many, there are a great number of no practical value, but here and there a brilliant idea shines forth that is well worth the many failures. A study of the records for the past year shows that several of the large manufacturing companies evidently purchase any new idea that can be covered up broadly and completely, whether it is of any present practical commercial value or not, so that should one of these plans come into favor they will have complete control and an exclusive monopoly of it.

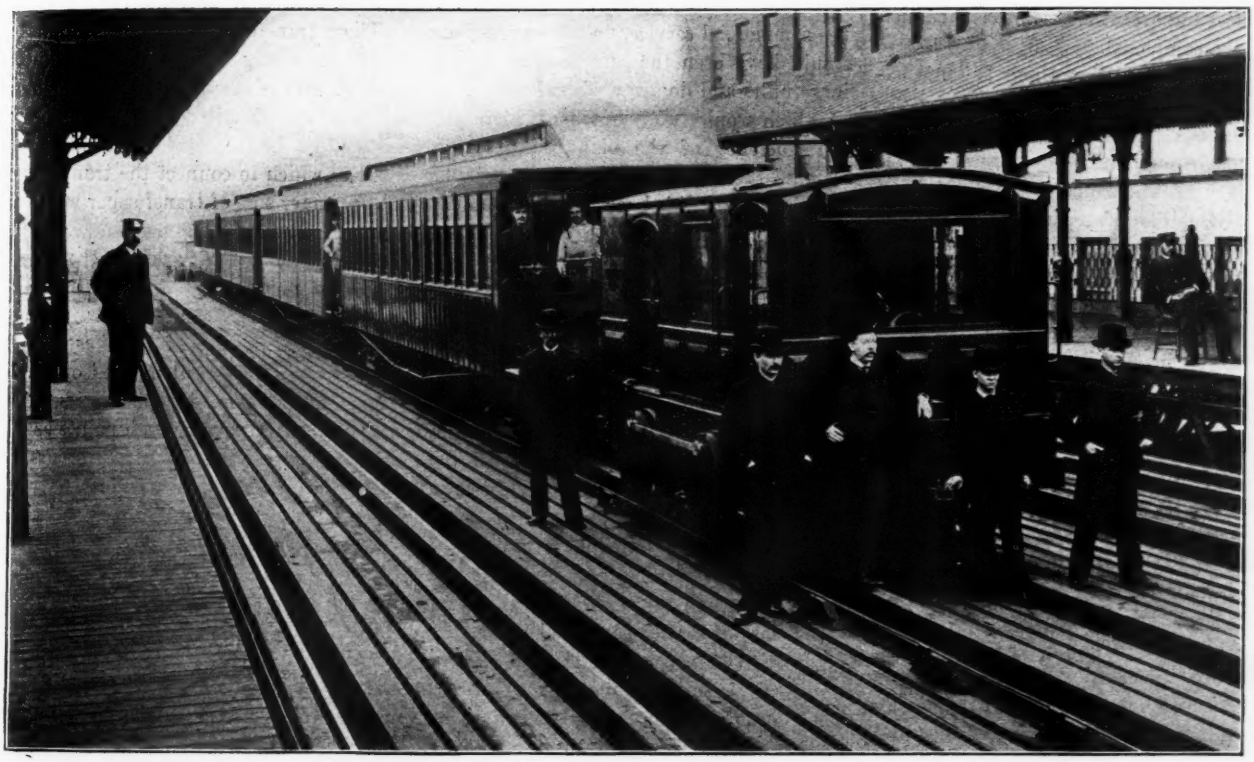
Among the purchasers of patents, the General Electric Company stands first. The records show for the first six months of the year that this company appears as owner on the face of ninety-eight patents which relate to all branches of electricity. Many of these have been described in the columns of this paper. Next stands the Lorain Steel Company with forty-five. After this comes the Western Electric Company, having twenty to its credit. The inventions covered by these patents are from various people who are continuously at work improving on old ideas and evolving new theories. The Siemens & Halske Electric Company has nine, mostly the work of Germans, and the American Bell Telephone Company, the Westinghouse Electric and Manufacturing Company and the Otis Elevator Company tie

with eight each. These seem to be the largest purchasers for the above period, though many others well known to the commercial world have two or three each.

When we come to the inventors themselves, as usual we find Thomas A. Edison in the lead with sixteen patents, the majority of which, however, are outside the electrical world, for Mr. Edison is apparently very much interested in mechanism of a novel form for crushing ore and rock. Professor Elihu Thomson is next with eleven, that are scattered broadly throughout the field of invention. Mr. George S. Tiffany, of Brooklyn, N. Y., has taken out ten patents on different improvements in the telautograph, which he has assigned to the Gray National Telautograph Company.

Another prolific inventor is Mr. Charles E. Scribner, of Chicago, Ill., who patented nine different devices for the benefit of the Western Electric Company. Mr. George Westinghouse, of Pittsburgh, Pa., besides patenting eight separate improvements on railway rolling stock, is buying up all patents on improvements in glower lamps, his record for the above period being nine on this one invention. In the electrolytic line, Mr. Max Marovan, of Niagara Falls, N. Y., has obtained eight patents that he has sold to the Castner Electrolytic Alkali Company. Mr. Benjamin G. Lamme, of Pittsburgh, Pa., is another inventive genius who took out four patents, all of which he has assigned to the Westinghouse Electric and Manufacturing Company. Another well-known gentleman is Mr. William F. Bossert, who procured four patents on electric switches and outlet boxes that are now being manufactured by the Bossert Electrical Construction Company, of Utica, N. Y. During the above period Mr. Marconi had three patents issued on as many improvements in his wireless telegraph system.

Yet this is only a very incomplete digest of the first six months of the past year. Patents are issuing all the time, and the Patent Office is far behind in its work, for the importance of protecting every improvement, be it great or small, is well understood by the great companies and well-informed inventors.



THE "BEN FRANKLIN" ELECTRIC LOCOMOTIVE WHICH WAS OPERATED BY LEO DAFT ON THE MANHATTAN ELEVATED RAILWAY, NEW YORK CITY, FOURTEEN YEARS AGO.—PHOTOGRAPHED JANUARY 20, 1888.

An Early Elevated Railway Electric Locomotive.

The accompanying illustration represents the electric locomotive, "Ben Franklin," which was in service for a short time on the Ninth avenue division of the Manhattan Elevated Railway, in New York, in the year 1888. The photograph was taken on January 20, 1888, at the Fiftieth street station of the Ninth avenue road and shows the locomotive attached to a trial train of four cars, each of which was loaded with old rails to represent the weight of a sitting and standing load of passengers.

The conducting system upon which Mr. Leo Daft carried on his now classical experiments consisted of a five-eighths-inch round copper rod, shod on top with a strip of Tobin bronze and resting on insulators composed of a cast-iron shell resting on blocks of fibre. Current was collected from this conductor by means of laminated copper brushes.

The power station was situated in West Fifteenth street, in a biscuit factory, where a large engine was available, and to this engine were belted four dynamos, each of fifty-horse-power, generating current at about 300 volts. The copper conductor was installed from a point below Fourteenth street to a point above Fifty-ninth street, and for a long period the electric trains were operated between the regular steam trains of the railway. It is interesting to note that fourteen years ago when this work was done the operation of this locomotive was so perfect that never once during the months of operation was a steam train delayed an instant by the presence of the electric train on the tracks.

The construction of the locomotive was somewhat curious. Its four driving wheels were coupled together by side rods, the motor driving one pair by means of a single reduction gearing. The motor was hung directly over one of the driving axles. It was of a two-pole type, having a Gramme armature. Its capacity was about 150 horse-power. Control was effected by commuting the field windings of the motor and also by the use of a resistance in series with it.

It is curious to note that this extraordinary piece of pioneer work failed of commercial success probably solely on account of its being so far in advance of its time. Its operation was very nearly perfect, and speeds of forty miles an hour were attained with the train shown in the illustration.

RECONSTRUCTING OR MODERNIZING CENTRAL STATIONS.*

BY O. M. RAU.

The extraordinary rapid evolution made in electrical equipment has made it impossible to keep our stations abreast of the times, and the discouragement of the enterprising manager who attempts to keep his equipment "up to date," only to find that before his improvements are in practical operation his plant is as much a back number as before, has been the rule rather than the exception, not only in the smaller installations, but also in the most important electrical construction recently completed.

With this condition there is some excuse for the obsolete apparatus in operation in the majority of smaller central stations throughout the country, the inefficiency of which makes the problem of the advisability of reconstruction one of simple mathematics.

The highest development has by no means yet been obtained in perfecting electrical generating apparatus and methods of distribution, but there are a number of definite conditions which can be acknowledged as sufficiently developed to leave little doubt of their permanency, and that future development will be in minor details which would not depreciate the apparatus in anything like the proportion the improvements of the past five years have. For this reason any of the old plants which have been holding on to their old equipment with the hope of making no mistake in changing to the best, should not hesitate to act, as the depreciation on old equipment is rapidly increasing, and the time is not far distant when an old type open arc or alternating-current generator will be unsalable, and its value will not be more than so much scrap metal, no matter how good its condition may be. No better example of this rapid depreciation can be cited than the open multiple arc lamp, which is to-day entirely superseded by the enclosed arc lamp.

The steam equipment of these stations, as a rule, receive their share of attention, and modern devices to increase the efficiency are noticeable in any of the smaller plants, but when it comes to the electrical apparatus the condition is quite different. We often find a number of small old type alternators, and assortment of twenty-five-light and perhaps a fifty-light series arc generators, and occasionally a 500-volt power generator, all driven by a mass of belting, shafting, clutch pulleys, etc.

A proposition of this kind naturally causes some hard thinking before a conclusion as to what to keep and what to throw out can be arrived at. The plant must furnish power, incandescent and arc light for commercial purposes, and light the city streets, the latter preferably done by a separate circuit from that supplying commercial lighting.

A short time ago a large arc machine of 100 or 125 lights capacity, to displace a number of smaller ones, would have been recommended for the city service, while for the commercial service, no two suggestions would have been the same, except to get large units and do away with shafting, all of which would, no doubt, have increased the efficiency of the plant sufficient to warrant the improvements, but they would not have simplified or economized the operation of the plant to any great extent.

The recent development of the alternating current has demonstrated that for the average central station (and I might go farther and include isolated plants) the flexibility of alternating currents leaves little to be desired, and for covering the unlimited demand that may come within the scope of a modern central station it is perfectly suited.

The efficiency of all apparatus in connection with alternating currents has reached a stage of perfection where no other class of service can equal it, and its application for commercial purposes is universal, with the exception of direct charging of storage batteries, which, at present, is not a defect to be seriously considered.

To-day the solution of our reconstruction problem is a simple one, and has none of the questionable points to cause delay in obtaining its proper solution that confronted the manager formerly.

A single generator, covering all classes of service desired, takes the place of our former assortment, and either direct-connected or direct-belted solves the shafting problem. If this generator is obtained large enough so that the engine is the weaker part of the unit, in case of a heavy overload or short-circuit, this excess of capacity is a valuable safeguard against its destruction.

Reconstructing a plant on these lines means abandoning all generators and installing one or two (preferably two) direct-belted (in the latter case from separate engines) three-phase alternating-current generators of the four-wire type having 2,000 volts potential to the fourth or neutral wire.

This generator can be used for various classes of service from the separate phases, taking, for instance, the commercial incandescent and arc lights in the business district from phase No. 1 to neutral, installing at a convenient location close to the centre of load a large transformer or bank of transformers, preferably placed in a manhole underground instead of attempting to hang the enormous weight of the larger transformers on poles where they are a continual source of anxiety and danger, as well as unsightly.

These transformers are to be connected to a secondary three-wire distribution system, and if the plant was previously operated on the direct-current three-wire system, no better network could be desired to which to connect the transformer. The primary side of transformer would receive the current at approximately 2,000 volts through a feeder from phase No. 1 as before stated.

The outlying commercial business would be taken care of by phase No. 2, similarly to the present method of single-phase distribution, by placing separate smaller transformers at such points as will serve the largest number of customers, or, when distance becomes too great, a transformer for a customer. But in all cases the three-wire secondary should be strictly adhered to, so that as the city expands and the business district grows, each secondary network may become part of the main secondary distribution system. All service should be three-wire wherever practical, and care should be taken to keep those that are two-wire alternately on each side of the system. This will maintain as near as practical a balanced load on the transformer.

From phase No. 3 the city arc circuits through constant-current transformers can be served, and with the alternating-current series enclosed arc lamp the highest economy, as well as the most satisfactory, street lighting can be obtained. These transformers can be located in the main power-house, or at transformer stations, centrally located in the lighting districts. In the latter case any shed, store or basement space could be utilized, as they require very little room. Or if desirable they could be placed in underground manholes similar to the transformers for the commercial circuits, although especial attention must be paid to thorough ventilation and drainage, so as to prevent trouble from the high voltage of the circuits.

*A paper read before the Northwestern Electrical Association, January 15, 1902.

The trimmer of the route centering at these transformer stations should be held responsible for this station and be required to start the lights by closing the circuit on these transformers at the proper time. This will ensure reliable service and avoid any difficulties that are encountered if started from the main plant, from where they can readily be shut down by opening the primary circuit.

The expense of trimming and maintenance of the enclosed over the open-arc system is very much reduced, while the usual deduction for lights out with its disagreeable controversy with the city officials is practically eliminated.

For the power circuits a separate three-phase feeder would be required from which power for motors would be taken, using a group of three transformers with a Y connection on the primary side and a delta connection on secondary side reducing the approximately 4,000-volt primary to 220-volt secondary. These transformers should be located so that the three-phase secondary circuit would reach a number of power customers, as the installation of transformers for single customers becomes very expensive. By the use of three-phase motors all trouble from excessive starting currents is overcome, and motors of any capacity within the range of the generating station can be successfully operated without any material effect on the incandescent circuits.

The most important feature of this method of distribution is the absolute control of each system, and the perfect regulation which can be obtained irrespective of the unbalanced condition of the load.

The series arc system being automatically taken care of by the constant-current transformer, the three-wire power circuit is not materially affected by variable loads, while on the commercial lighting circuits, regulating transformers giving a range of ten per cent above or below the generator potential can be placed in each feeder, and by means of a hand-wheel constant potential can be maintained under all conditions of load.

In some instances a source of revenue is available at a considerable distance from the station. Perhaps a neighboring town, too small for an independent plant, a manufacturing plant, or some institution too far distant to be reached economically by the ordinary 1,000-volt system. In this case a feeder of two wires from one of the phases is used, giving a potential of approximately 4,000 volts, at which pressure the feed wire becomes a small factor and a considerable distance can be economically reached. By using two standard 2,000-volt transformers with primaries in series and secondaries connected for standard voltage using the three-wire secondary distribution system such business can be successfully taken care of.

In advocating the three-wire secondary distribution system many points of advantage are obtained, the most important being the availability of 220-volt current at all services. Not only is the tendency to increase the voltage of incandescent lamps little by little, but the time is not far distant when a 220-volt lamp will be as efficient as those of lower voltage, and with the supersedence of the multiple enclosed arc lamp by the Nernst lamp, the advisability of providing 220-volt secondary service can not be questioned.

In preparing these few remarks my object was to point out a plan of reconstructing the many smaller central stations which are operating with old inefficient apparatus, the value of which is so rapidly depreciating that most of it can only be appraised at scrap value, the owners of which have been delayed in taking action due to the rapid change made in electrical apparatus, and I hope my suggestion may help to decide this perplexing question.

Using Up Rubber Scrap.

The utilization of rubber scrap is of very great importance, for anything that can be added to new rubber to decrease its cost and increase supplies must be welcome, providing that the compound is serviceable. The scraps are sorted according to their composition, and then cleaned by boiling, which removes dirt, absorbed and adhering acids, and free sulphur; but attempts to desulphurize vulcanized rubber have not been successful yet. The waste is ground between rollers and reduced to powder in emery grinders with automatic feeding, and in many cases the resultant material can be added at once to the new rubber mixture; but, generally, it is treated chemically by being boiled in a caustic soda solution or sulphuric or hydrochloric acid, and then steaming for about twenty-four hours at a pressure of four atmospheres. In another method, the ground scraps are steamed with soda lye under pressure, thoroughly washed twice to remove the lye, and then dried in vacuum. Then they are mixed between cold rollers with from five to ten per cent of benzol or mineral oil and steamed for several hours, at the same pressure as above. After either of these processes, the product is rolled into plates and then added to the rubber dough.

Lightning-Rod Agents Again!

To the Editor of the Electrical Review:

As I am a victim of lightning-rod men (or at least I think so) is why I write you. I wrote the *National Tribune,* Washington, D. C., for some good authority on electricity, and they referred me to the Electrical Review, stating that you would give me all the information on the subject needed. There are men going through this country putting lightning-rods on houses, the material being five-eighths of an inch copper tubing, put on top the house in circular form, four points, each five feet high, and one ground rod; the tubing is fastened in metal supports nailed to the roof without any glass insulators. I have it on my house, and protested against having it put on without insulators, but they laughed at me and called me an old fogy, stating that science had now demonstrated that insulators were not necessary. I feel a little shaky on this point, and feel that it is dangerous instead of a preventative against lightning. I will not feel satisfied until I have it scientifically settled. I will esteem it as a great favor if you can settle this matter, whether a rod put up in that manner is safe or not, as I do not regard the say-so of a lightning-rod man as very good authority. Please answer at your earliest convenience. S. W. S.

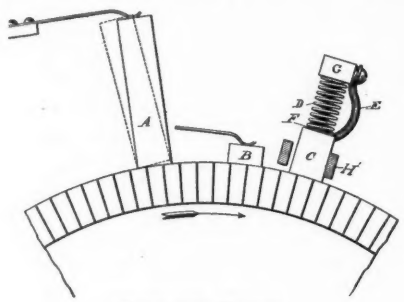
Lorraine, Tenn., January 4, 1902.

[We believe that you are reasonably safe with your lightning-rod apparatus in the winter-time. Before the summer comes on we should urgently recommend you to take it off the house and move it some distance away. The present state of science is such that no man can tell whether a lightning-rod does more good than harm or more harm than good. It is likely that if the copper tube you speak of is big enough and sufficiently well grounded, and the lightning flash is aimed directly at your house, that some part of it, or possibly all of it, may go to ground over the lightning-rod. This is all that can be said. If your house has a tin roof it is reasonably safe anyhow. If it has a steel frame construction, or is full of water pipes, it is still safer. If it is a frame house with a shingle roof you can secure entire safety for it by building a copper house outside of it. This, we believe, is the only absolutely efficient lightning protection.

The whole matter of lightning-rods was conceived in ignorance and has been exploited in folly. It is not now believed that the ordinary lightning-rod does any good, or, on the contrary, that it does any particular harm. Insulators will not help it nor will they harm it. If we were living in your house we would rather not have the lightning-rod.—Eds.]

Electrical Patents

Mr. Charles G. Curtis, of New York city, has recently devised an improved commutator brush which claims decided advantages over the present type. It is well known that these devices, while they give good results on low-speed commutators, are very unsatisfactory when applied to commutators having comparatively high peripheral speeds, and that sparking soon sets up while the commutator becomes so rough that it requires frequent sandpapering and re-turning. Mr. Curtis, after closely investigating the matter, discovered that this arcing and rapid roughening were mainly due to the imperfection of contact between the face of the carbon brush and the copper, resulting either from the change of angle or tilting of the brush, or from the failure of the same to follow the irregularities of commutator surface because of its inertia. After numerous experiments he finally overcame these difficulties in a very simple manner, and has provided a brush that gives highly satisfactory results at high speeds. This brush is based upon the principle that by making it sufficiently short compared with its width, tilting will be prevented, and the brush necessarily seats itself truly against the surface of the commutator. At the same time, its weight and inertia are so much reduced that with a given spring pressure the block of carbon remains upon and in constant contact with said surface. In the accompanying illustration, taken from the Patent Office drawings, A illustrates the present type of carbon commutator brush, having the usual proportions. B is a similar very short brush or thin block carbon, and C illustrates the improved carbon brush. It is evident on studying the forces at work that in the case of a brush like A, whose length is several times as great as its width, it is quite possible for the brush in vibrating to change its angle or tilt, as shown in dotted lines, whereas in the case B, where the depth or length of the brush is very small compared to its width, tilting becomes impossible, and the spring pressure necessarily ensures the constant seating of the brush against the commutator face. In the improved brush C, it has been found that by using a brush having a length approximately one and one-half times its width (the spring being a spiral one, as shown) there is no tendency to tilt, and the action is so perfect and the commutator surface becomes so smooth and polished by the action of the brush that a brush of this character will last longer than a long brush of the old type. It will be understood that the width of the brush perpendicular to the surface illustrated in the drawings (or parallel with the commutator bars) is greater than the width of the surface shown and may be as great or even greater than the length of the brush. There is preferably used a spiral spring D, with the end touching the brush free, so as to avoid all lateral friction on the brush and leave it free to assume the position which maintains its face in full contact with the commutator surface. By using a spiral spring of considerable diameter, provided with a shoe F, where it presses against the brush, the spring will tend to preserve the angle between the brush and the commutator, even though the brush should tend to wear a little faster on one side than on the other. The spiral spring bears against the back-yoke



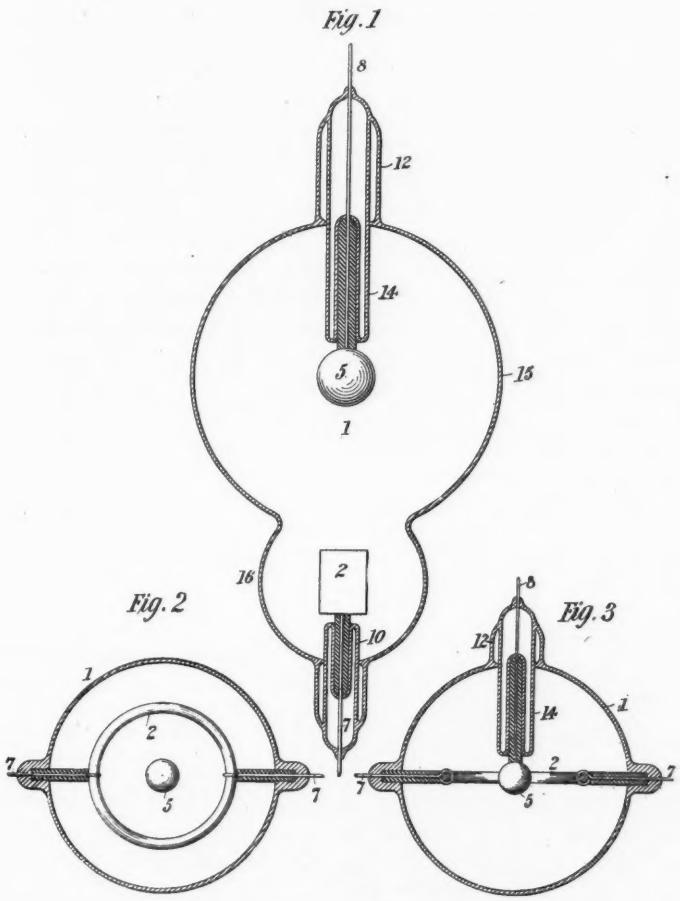
IMPROVED BRUSH.

G, forming part of the brush-holder, which brush-holder also includes a suitable channel or recess for loosely guiding the carbon block and including a bearing-bar H, against which the block is pressed by the movement of the commutator and which restrains it from following that movement, but permits a free rocking movement of the block, so that it can follow the irregularities of the commutator. The carbon block is copper-plated, as usual, and a flexible conductor E, soldered to the metallic coating of the block, is carried back to a stationary part of the brush-holder, as to the back-yoke G.

Mr. Peter Cooper-Hewitt, of New York city, has just patented a new method of electric lighting. The invention relates to that class of electric-lighting devices in which electric energy is transformed into light by its action upon gases or vapors enclosed in a suitable chamber with a suitable light-emitting electrode. In the operation of lamps of the character referred to it has been found that suitable gases, having the proper density, may be so affected by electric currents of moderate electro-motive force as to yield light and cause the negative electrode to be heated to a high degree of incandescence. A large portion of the resistance which a lamp of this character offers to the passage of currents is at the joint of the gas with the cathode where the current enters the cathode, the gas also presenting considerable resistance. By suitably adjusting these resistances the resistance at the cathode may be made such that the cathode will itself become heated to a high degree of incandescence, being itself near the centre of the source of heat and emitting intense light. The relative amount of light developed in the vapor-path is small on account of the relatively short path of the current through the vapor, and a certain portion of this vapor-path is occupied by the dark space which surrounds the negative electrode. In operating lamps with currents of considerable quantity the electric current tends to pass around to the back of the cathode and unless prevented is liable to fuse the leading-in conductors and disintegrate the glass through which they pass. To prevent this there is provided a protecting covering for such portions of the electrode, leaving exposed only those portions at which it is desired that the current shall enter.

In the accompanying illustrations Fig. 1 illustrates one form of lamp, and Figs. 2 and 3 a modification: 1 represents the main body of the lamp, 2 represents an electrode, in this instance the anode, located in the lower part of the lamp, and the cathode is represented at 5. The electrodes may be made of suitable material—such, for instance, as iron or other conducting material; but the cathode may be made of some light emissive material, such as rare earths or mixtures thereof, surrounding the conductor leading the current to it. The nature of the material of the cathode makes but little difference with respect to its conductivity, as even when it is of a material which is a non-conductor when cold there is sufficient electric leakage into the lamp from the conductor leading into it (unless great care be taken to prevent it) to start the current which, when started, will heat the material by reason of its position at the negative electrode. The electrode 2 is shown as being seated within a glass column 10, which surrounds the leading-in wire 7; but the position of the positive electrode for this style of lamp may be varied. The electrode 5 is shown as being seated within a tube 14 of porcelain or other suitable material, which is a non-conductor and retains this quality when hot and is inert to electrical and chemical actions at the temperature to which it is

subjected in the operation of the lamp. The cylinder 14 is shown as being carried by the stem or column 12 of glass through which the leading-in wire 8 passes. The joints between the electrode and the porcelain and between the porcelain and the glass are sufficiently tight to prevent the electric current from passing through them and reaching the metal parts within, thus forming an electrically-tight insulation over the conductor leading through the walls of the vessel to the electrode. With electrodes of the character described the lamps can be operated so that the current will pass to and from the electrodes and be prevented from passing around to the portions near the leading-in conductors. The lamp illustrated in Fig. 1 is so constructed and its elements are so arranged that in the normal operation of the lamp the cathode will be heated to a very high temperature, becoming itself a light-emitting body. In this instance the electrode 5 is located at the centre of a globe 15, the anode 2 being carried in an extension 16. Gas of the proper density is placed within the globe. When the current traverses the lamp considerable heat is generated at the cathode 5, and the surrounding gas being, in a measure at least, a non-conductor of heat the temperature of the cathode 5 is maintained sufficiently high to be light-emissive. It has been found, for instance, that with attenuated nitrogen contained within the chamber and with iron electrodes separated a distance of about one and a half inches, the lamp may be started with a direct current having a pressure of 750 volts or less, and the resistance which the gas offers to the passage of the current and the resistance which is offered between the gas and the cathode will render the lamp self-governing and pass a definite amount of electrical energy and convert it into light and heat, the heat being sufficient to maintain the cathode in a state of incandescence. It has been found that the resistance of a vapor varies inversely with the current, but in the operation of the lamp in the case of an increase of current the consequent reduction of resistance in the vapor-path is compensated for by an increased resistance at the cathode, and *vice versa*. This particular form of resistance is a phenomenon that takes place under proper adjustment when there is no chemical or physical action at the negative electrode. The feature of self-regulation is important, whether the lamp be constructed to yield light merely through the instrumentality of the gas or by reason of the incandescence of the negative electrode, or both. In this lamp the resistances at different points may be different at the time of starting from what they are when the lamp is running, but by properly adjusting the gas density the lamp may be made to start on the same current that it is designed to operate on. In Figs. 2 and 3 there is shown the enclosing case in the form of a globe, the cathode being surrounded by an anode 2, made in the form of a ring. The operation of this lamp is essentially the same as already described with reference to Fig. 1. To bring about a condition where there is no physical or chemical change of state, it usually becomes necessary to electrically treat the lamp while on the pump, so as to produce such reactions as would be incidental to the presence of minute quantities of impurities or dirt inside the lamp, due to imperfect commercial manufacture. Having continued this until no further reactions are apparent, the true vapor may be introduced into the lamp, and its density varied until the desired result becomes apparent.



FIGS. 1, 2 AND 3.—VAPOR LAMPS.

"Syntograph."

TO THE EDITOR OF THE ELECTRICAL REVIEW:

I notice that your valued paper has been for some time groping around in the vain endeavor to find one brief word to cover wireless telegraphy. I venture to suggest that since wireless telegraphy may properly be called syntonic telegraphy, the word "syntograph" may be employed. While this is a coined word it has the advantage of being properly derived, as all its elements come from the Greek. The word is made up, as you can readily see, from *συν*, meaning with, *τωνος*, meaning tone, and *γραφειν*, meaning to write.

From syntograph will follow naturally such words as syntogram and syntography. It seems to me that this word would cover the idea without being too long or difficult of definition. J. FRANKLIN STEVENS.

Philadelphia, January 15, 1902.

M. Jaubert compresses powdered carbide of calcium into tabloids by a pressure of 300 kgs. per square cm. A smooth cake of carbide is obtained without the use of any agglomerating material, and it is hoped that the process will enable manufacturers to utilize the at present worthless residues of carbide. (French patent 308,391.)

Thoughts on the Trolley.

To the Editor of the Electrical Review:

Scarcely more than fifteen years ago the cities of this country were getting along as best they could with the primitive horse cars, a few cable lines, with a straggling stage crawling hither and thither athwart the vision. Business men who lived some distance away had to use up a large amount of time going and coming, morning and evening. Naturally they felt compelled to rise very early to get to their offices in due season. The horse cars were few and far between, cable cars ran only on a few thoroughfares, and stages or busses were out of sight when wanted.

The electric railway and trolley car came on the scene, and in these few years they have revolutionized business and transformed our whole domestic economy. The people of all classes soon recognized the advantage of rapid transit, and the success of one street railway inevitably led to the adoption of the new system by rival companies. All made money, because they gave the public a new benefit—rapid transportation. The public saw the gain and was pleased. City after city came into line, new franchises were asked and granted, and trolley cars began to rush through streets and districts never before rumbled by a car-wheel. Steel tentacles reached away out into the suburban areas. And to-day every city in the land, and nearly every small town is gridded and girdled by the wonder-working trolley car.

And truly wonder-working it is. It has done more individual good and imparted more personal satisfaction to the denizens of the world than any other improvement yet wrought. It reaches and blesses the poor and the rich alike. All use it, none can do without it. It saves time for the workingman, the storekeeper, clerk, lawyer, judge, broker and banker. All can sleep a little longer in the morning, all can work later in the evening. To our wives, daughters and sisters it has been a boon, as they well know.

Yet we grow captious as we receive more and more from the great storehouse of science. A man would, a few years ago, stand at his corner meditating or scanning his paper, patiently waiting to hear the jingle of the horse car, and when it came would step on quietly and at least start for his destination. To-day, the same man at the same corner fumes and swears because the car is a few blocks away, and when, in a few seconds, he boards it, he can't sit down without a few peppery remarks to the poor conductor about "rotten management," etc. He forgets those wintry mornings a few years ago, the raw wind, snow, slush, cold feet, damp, straw-tiled and fireless horse cars on slow time and uncertain schedules, for whose cheerless comfort he was only too glad to pay his nickel. The same railway companies sold off their worn-out cars, their horses, good and bad, tore up their old-fashioned tracks and spent millions of dollars in replacing them with the splendid equipments we see everywhere; rapid transit and frequent service became the rule. Yet the forgetful public howls at the monopolistic railway owners, and demands still more.

It is human nature to forget hardship and misery, but it is inhuman to cry down the men whose capital has been boldly launched into these vast enterprises which the public to-day could not dispense with. Those bold pioneers of years ago, as well as the great corporations which now operate the street railways, have been and are entitled to their profits. Let them have it, and welcome. Let us try to see that in return we are getting nowadays for our nickel many times more than was obtainable but a few years ago. Let us ignore the demagogues who keep shouting against the march of improvement, and remember that is their business. They have to shout at something, or go into obscurity—which would not pay.

We pay the nickels and most of us are satisfied, in the reflection that we are getting a lot for our money. E. M. D.

Harrisburg, Pa., January 2, 1902.

Electrolytic Alkali Developments.

This industry is showing considerable activity. In the original Acker process it will be remembered that a jet of steam was made to keep up a rapid circulation of the molten lead, while at the same time oxidizing the contained sodium into caustic. It was found, however, that the quantities required for the two purposes were not alike; an amount of steam sufficient for the mechanical effect was too much for the chemical and produced a diluted lye. A new American patent of December 3 circulates the lead by a bladed propeller, and adjusts the steam solely to the chemical action.

Among the many modifications of the Castner-Kellner process is Professor La Cour's Danish method of treating the amalgam. He says that in order to obtain the most favorable result in the electrolysis of alkaline chlorides with a mercury cathode it has been proved absolutely necessary for the absorption of the alkaline metal and its subsequent leaching to take place under unvarying conditions. In his apparatus an iron trough is divided into cells by partitions, stopping just so far short of the bottom as to allow a thin stream of mercury to be drawn through the whole series, at the same time sealing off one cell from another. The odd cells contain anodes, and are filled with the alkaline chloride solution, the even cells contain a dilute lye, both liquids being kept at a constant level. In the even or leaching cells, just above the mercury is stretched a diaphragm of wire gauze. The amalgam formed in the cells containing the anodes flows under the partition and is decomposed by the lye. The latter is said to become concentrated very quietly and uniformly, while the amalgam is so regularly washed that "quite pure mercury" passes on into the next anode cell. The outlets below the gauze lead to a "mercury lock," and as soon as the density of the dissolved alkali becomes greater than the weight of mercury the former begins to flow out, being replaced by weaker solution from above the gauze. The bottom of the trough must be kept perfectly horizontal, and, in fact, the whole apparatus, though ingenious, would require very delicate adjustment, and appears, like many hopeful automatic arrangements, to be very liable to get out of order. The English patent, No. 1783, was accepted November 30, 1901.—*Electrical Times.*

A Slot Machine Episode.

With fear and excitement she sped her way
To telephone the alarm without delay;
The fire it raged, while the maiden brave
Released the hook and the signal gave.

"Give me the fire department, quick!" she cried,
And equally quick a sweet voice replied,
"Put a dime in the slot"—that's all she said,
And the fire burned on and the maiden fled.

Now all this happened in a curious way,
For the maiden knew she had money to pay,
But dresses are different from trousers, you know,
And searching for pockets is deucedly slow.

Buffalo, N. Y. H. W. P.

A device for protecting bearings from heating has been patented in America. An ordinary oil-cup is placed on the bearing to be protected, and has communication therewith through the usual opening. This opening is, however, closed at its lower end by means of a fusible plug that will be melted at a low temperature. Should the shaft or bearing become heated to a sufficient degree, owing to the neglect of the attendant from any other cause, the plug will be fused or liquefied by the heat, thereby releasing the oil.

A Protected Type of Dynamos and Motors.

The accompanying illustrations represent a new type of dynamos and motors which has been lately brought out by the Robbins & Myers Company, of Springfield, Ohio. As the name indicates, the machine has the advantages secured by complete enclosure, although enough ventilation is allowed to secure cool running. The yoke ring or head, and these plates are secured in position by cap-screws, a construction which permits easy access to the field coils or armature when necessary. The general type of construction employed ring of these machines is made of a special mixture of gray cast iron, while the pole-pieces and cores are made of sheet steel stampings. The end-plates are cast in a single piece in the form of an enclosing may readily be seen from the illustration showing the disassembled parts of one of these motors. The commutator, it will be noticed, projects through the front end-plate in such a manner as to be protected by the arms and yet left in full view for inspection, cleaning and adjustment. As will be noticed from the illustration these machines combine no little grace of design along with the mechanical features of merit mentioned above.

The machines are made in sizes of from one-quarter to twelve and one-half kilowatts. A special design for smaller sizes between one-sixteenth and one-eighth horse-power is shown in Fig. 3. These small machines are used chiefly for operating sewing machines, small lathes, automatic pianos, etc.

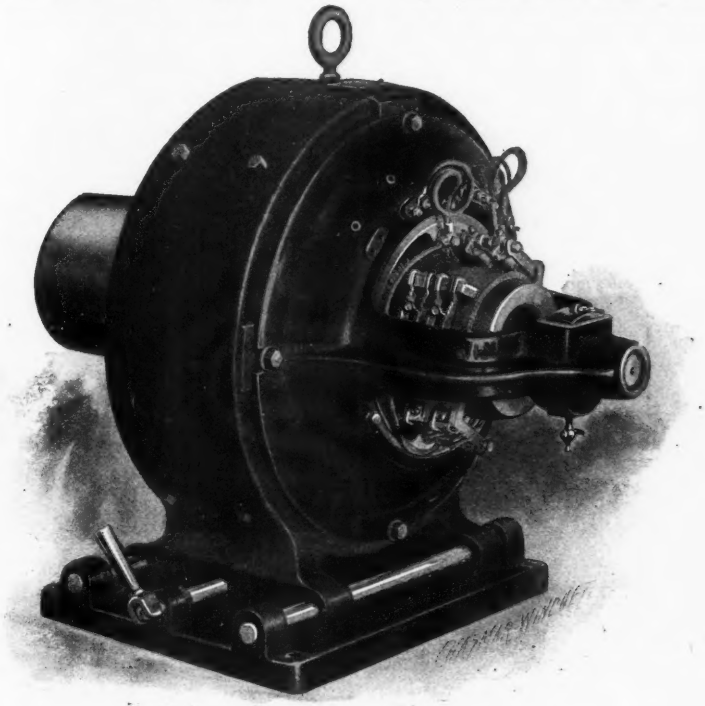


FIG. 1.—PROTECTED TYPE DYNAMO OR MOTOR.

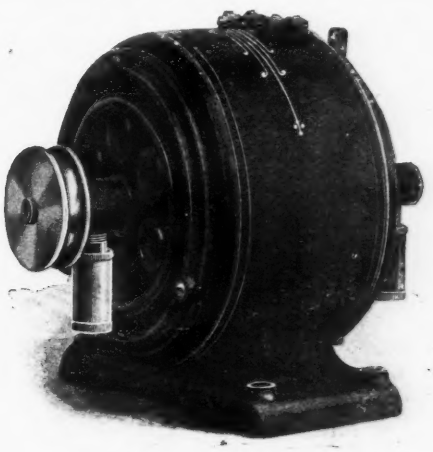


FIG. 3.—SMALL PROTECTED TYPE MOTOR.

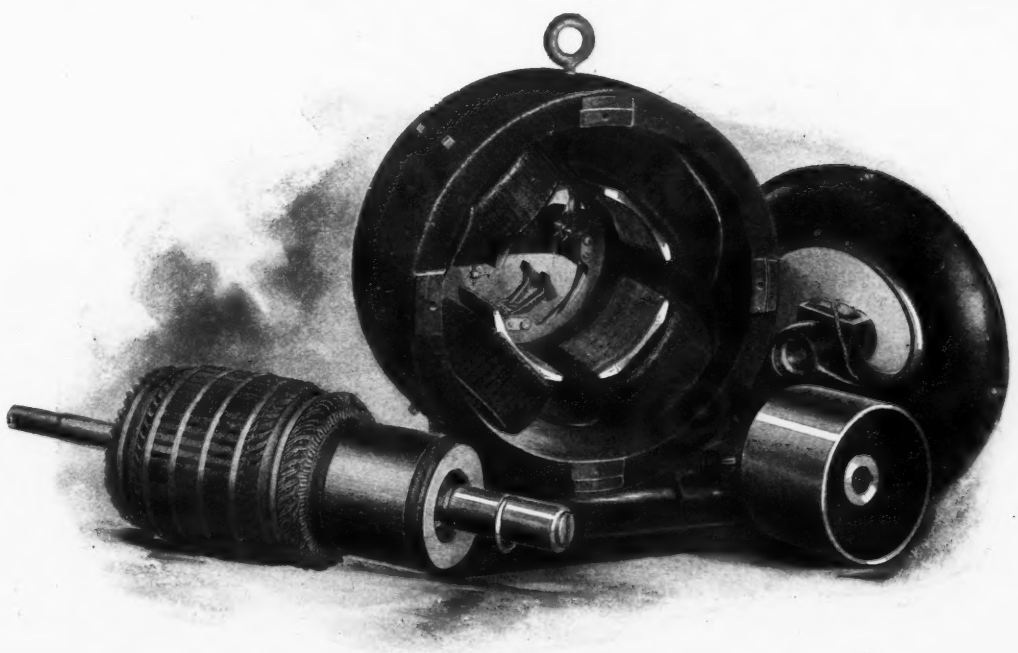


FIG. 2.—PARTS OF PROTECTED TYPE DYNAMOS AND MOTORS.

THE COMMERCIAL IMPORTANCE OF ALUMINUM—I.*

BY PROFESSOR ERNEST WILSON.

So far as I have ascertained, no paper dealing with the progress in manufacture and general properties of aluminum has been read before the British Association during the last ten years. During this period enormous progress has been made in the production of aluminum, as can be gathered from the fact that in 1900 no less than 5,000 tons were produced by plant having a combined output of about 25,000 horse-power, representing a capital of over £2,000,000 sterling.

Progress in Manufacture—As far as is known, aluminum exists nowhere uncombined in the metallic state, and its production is essentially a chemical operation. The introduction of the electrolytic process for the production of aluminum marks an epoch in the history of this subject, as at the present time (1901) all aluminum may be said to be produced by this method. The process was patented in 1886-1887 by Hall in America, and Héroult in England and France. In 1888 Hall was at work with it on a commercial scale at Pittsburgh; in 1891 the plant was removed to New Kensington, and was gradually enlarged to 1,500 horse-power, and in 1894 works of 5,000 horse-power were erected at Niagara Falls. In 1890 the Hall process operated by steam power was installed at Patricroft, Lancashire, but the French and Swiss works operated by water power in 1894 ruined the enterprise. About 1897 the machinery at St. Michel passed into the hands of Messrs. Pechiney, and was soon increased to 3,000 horse-power, and here aluminum is still being manufactured by the Hall process. At Neuhausen about 4,000 horse-power is obtained from the Rhine, at Rheinfelden about 2,000 horse-power, while about 3,000 horse-power is used by the Société Electro-Metallurgique Française, of La Praz, near Modane. In 1895 the British Aluminium Company was founded to mine bauxite and manufacture alumina in Ireland, to reduce the aluminum at Foyers, and to refine and work up the metal at Milton, in Staffordshire. By the end of 1899 plant of 7,000 horse-power had been installed at Foyers; some of it, however, being employed for the production of calcium carbide. In order to meet the demands of the Pittsburgh Reduction Company, and as an indication of what is expected of aluminum, it may be mentioned that the Niagara Falls Company is installing two new turbines. Space does not permit of further description; but the above remarks are sufficient to show how rapidly the electrolytic process has been developed.

The Electrolytic Cell—A short description of the Héroult cell which is used at Foyers may be here given. It consists of a square iron or steel box lined with carbon, at the bottom of which is a cast-iron plate connected with the negative pole of the dynamo. The positive pole of the dynamo is connected to a bundle of carbon rods suspended from overhead and capable of vertical adjustment. The cell is filled with cryolite, which becomes molten by the passage of the electric current, and then the powdered alumina is fed in continuously as long as the operation proceeds. The potential difference between the terminals of each cell is from three to five volts, and the current overcomes the chemical affinity of the aluminum oxide, besides heating the electrolyte. The operation is essentially a dissociation of alumina into aluminum, which collects at the cathode or negative plate, while the oxygen, which is evolved at the anode or positive pole, combines to form carbon monoxide and dioxide. The current density is about 700 amperes per square foot of cathode, and the working temperature varies from 750 degrees to 850 degrees centigrade. The actual yield is one pound of aluminum per one electrical horse-power-hour.

Alloys—Aluminum can combine to produce an enormous number of alloys, some of which, containing one or two per cent of other metals, combine the lightness of aluminum with greater hardness and strength. Other alloys containing from 90 to 99 per cent of other metals exhibit properties of those metals much improved for certain purposes. Much as has been already done, much more remains, and the alloy-producing property of aluminum opens up a vast field for research. It must be remembered that electrolytic aluminum has only been known during the last few years, and now that its purity can be controlled on a large scale, consistent results may be obtained. The purest aluminum obtained commercially contains traces of iron and silicon, giving about 99.6 per cent of aluminum in the finished product. All aluminum may be said therefore to be used in the alloyed state. The subject naturally divides itself into two branches: (1) Light aluminum alloys; (2) heavy aluminum alloys.

Light Alloys—The color of commercially pure aluminum depends upon the temperature at which the metal has been treated. Cast in chill moulds and cooled quickly, or cast in green sand at a low temperature, the metal has a bright white color nearly like that of silver. When cast too hot in dry sand the color is gray like lead or bluish like zinc. The fracture grain differs considerably, according to the method of casting, cooling or working. When drawn, rolled or forged, the metal shows a silky grain. The specific gravity of commercially pure aluminum varies at atmospheric temperature from 2.56 when cast in sand, to 2.71 when hammered or drawn. Compared with other metals, its specific gravity is as follows:

Aluminum	1
Zinc	2.7
Tin	2.76
Cast iron	2.91
Nickel	3.37
Copper	3.37
Silver	3.98
Lead	4.30
Gold	7.31
Platinum	8.15

The extraordinary lightness of aluminum is one of its most striking characteristics. Since the weight of a given volume of a metal may govern its financial value, copper being 3.37 times as heavy as aluminum, it follows that whenever aluminum costs less than 3.37 times copper, it is cheaper volume for volume. The prices of metals fluctuate very much, but taking copper at £70 and aluminum at £130 per ton, we see that aluminum is considerably cheaper than copper. It remains to be seen in what manner the volumes of different metals have to be related for specific purposes.

Conductor of Electricity—The use of aluminum as a conductor of electricity is engaging the attention of engineers very much at the present time, and already large quantities of it have been installed. A number of different alloys of aluminum have been tested at King's College, London, for the British Aluminium Company, and it is the intention of the author to publish these in full later, but a general reference may be made. Aluminum (containing 0.31 per cent Fe and 0.14 per cent Si) has a specific resistance of

$$\left\{\begin{matrix} 2.59 \times 10^{-6} \text{ legal ohms at } 0^\circ \text{ C.} \\ 2.762 \times 10^{-6} \text{ " " } 15^\circ \text{ C.} \end{matrix}\right\},$$

a temperature coefficient 0.00393 and linear coefficient of expansion 0.000023 between 16 degrees and 100 degrees centigrade. Weight for weight the conductivity of this aluminum is double that of copper, or, for equal conductivity, half the weight of aluminum would be required; or for a given length of conductor carrying the same electric current with the same loss, that is, the same fall of potential, the relative weights would be as one of copper to one-half of aluminum. This necessarily involves a great saving in transport, and there is the additional advantage that fewer and lighter poles are required for erecting overhead conductors.

* A paper recently read before the British Association for the Advancement of Science.

Electric Signals on Mail Boxes.

The Post Office Department has authorized the experimental establishment in Toledo, Ohio, of an electrical appliance to record collections from street and office mail boxes. The object of the proposed system is to prevent collectors of mails from skipping boxes. The device is so constructed that whenever a box is opened a record of the opening is signaled to the post office. Where there are a great many boxes, in cities of a population of 100,000 and over, it is thought the system would prove valuable. It would also be a valuable addition in sparsely-settled communities, where boxes are a long distance apart. Here, it is reported, collectors frequently skip boxes. This violation of regulations could be entirely prevented if the electric appliance was attached to each box.

New Cable between Ireland and the Azores.

Consul Thackara reports from Havre, December 5, 1901, that the Commercial Cable Company, of New York, has laid a new submarine cable between Horta, Island of Fayal, Azores, and Waterville, Ireland. The shore connections at the latter place were successfully made on November 30. This cable, says the consul, is an extension of that laid by the same company in 1900, and increases to four the number of cables operated by the Commercial company between Canso and Waterville. As Havre is connected by a submarine cable with Waterville, the direct-telegraph service with New York will be benefited by the new cable.

To disintegrate wood fibre the material is crushed and disintegrated in lime water for some days. It is then piled to a height of two or three feet on a horizontal wire mat, which acts as one electrode, and placed in the electrolyzing tank, a similar mat forming the other electrode. An alternating current of about fifty amperes per ton of material is then passed through the bath at a voltage of about forty, says *The Electrochemist and Metallurgist.* This current, which is sufficient to keep the temperature of the material over fifty degrees centigrade, is passed for about six hours. The inventor of the process, M. Berget, of Paris, claims that this alternating current very considerably increases the speed of fermentation in the agglutinants of wood fibre, thus preparing it for lixiviation and bleaching. It is probable that the germicidal action is due to the products of electrolysis rather than to the direct action of the current itself, which as a rule is sterilizing rather than germicidal.

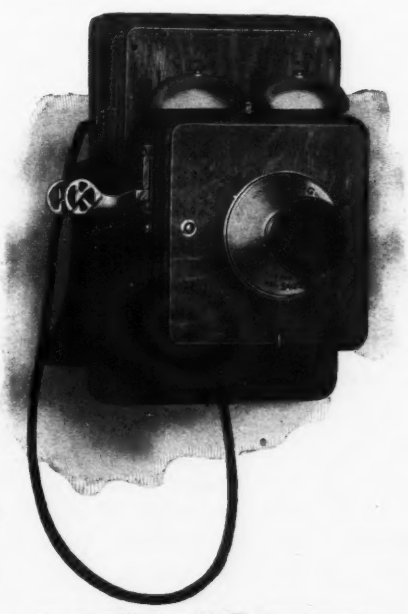
Mr. J. J. Nate.

Mr. J. J. Nate, for some time past general superintendent of the Standard Telephone and Electric Company, of Madison, Wis., has resigned his position to accept a prominent place on the force of the Stromberg-Carlson Telephone Manufacturing Company, of Chicago. Mr. Nate felt convinced some time ago, by reason of the rapidly growing telephone interests of the country, and especially the Middle West, that his proper sphere of action lay in Chicago. During the last six years Mr. Nate has been one of the moving spirits of the work of the Standard company, and has gained his experience through twenty-five years in service with both Bell and independent companies. His excellent work with the Standard company is well known and has made Mr. Nate widely acquainted with a large body of those interested in telephone affairs. In going to Chicago and connecting himself with the Stromberg-Carlson company Mr. Nate has selected one of the concerns which, by its present prominence and able management, has already shown an ability and intention to go to the front rank among similar organizations.

J. J. NATE.

Central-Energy Hotel Telephones.

In response to numerous enquiries that were received regarding high-class instruments for hotels, residences and other places where a small, well designed and compact telephone set is needed, the Kellogg Switchboard and Supply Company, of Chicago, has recently brought out the instrument here illustrated for this type of work. The apparatus is standard and has the same type of hook-switch, of ringer, receiver and transmitter as the same company's regular central-energy exchange telephones. The base of the instrument contains a condenser of the company's own make. It is stated that the Kellogg company is considerably the largest manufacturer in the United States of condensers for telephone purposes.



CENTRAL ENERGY HOTEL TELEPHONE.

It will be noted that the set exhibits no binding-posts or any other parts so exposed as to render them liable to be put out of order. The clapper of the bell is covered with a small guard to prevent people from changing its adjustment or tampering with it in any way. The apparatus is, of course, of the long-distance type and may be used in connection with the regular central-energy exchanges, and for any long-distance conversations of which the regular exchange apparatus is capable. The new line of apparatus is believed to meet a really considerable want. The beauty of its general design and appearance may readily be seen from the accompanying illustration.

"The Four-Track News."

The passenger department of the New York Central & Hudson River Railroad has begun the publication of a monthly magazine of travel and education, the first number appearing January, 1902. Its front cover is a very attractive page showing a scene on the Mohawk Valley on the line of the New York Central road.

The magazine is printed on coated paper, is abundantly illustrated and contains a number of very interesting contributions from writers on transportation and scenic topics. California scenery of timely interest predominates. The magazine is published at the Grand Central Station, is issued monthly at five cents a copy or fifty cents per year, and we think will fill a field peculiarly its own and one that should soon comprise the entire public who travel.

Mr. J. Pierpont Morgan has undertaken to find the necessary funds to complete the installation of electric light in St. Paul's Cathedral, where the wiring has been finished for some time, but, owing to lack of funds, the fittings have not been put up. The estimated cost is £9,000.

Chicago Electrical Notes.

(By Our Special Correspondent.)

ON January 7 Judge Tuley rendered his decision in the suit of the Illinois Manufacturers' Association against the Chicago Telephone Company granting a preliminary injunction restraining the telephone company from charging more than $125 a year for its service. In 1889 a city ordinance was passed which fixed the maximum charge for telephone service at $125 per annum. Several years ago when the company introduced metallic circuits and made other improvements it claimed the right, on account of increased operating expenses, to increase the charge for service and the rate was fixed at $175. This eventually resulted in the suit which has just been decided. In his decision Judge Tuley holds that the contention of the telephone company is wrong; that these improvements were the natural development of its business, just as the improvements in the street railways, the telegraph and the steam railroads have been. The suit has attracted much attention. There is some probability of suits being brought by patrons of the company to recover the amounts which they have paid above the legal charge.

The passage of a three-cent street railway fare ordinance by the city council of Cleveland last week has given some encouragement to those Chicago people who have been advocating reduced rates in this city. The results of the Cleveland ordinance will be eagerly looked for. Some doubt is expressed as to whether Mayor Johnson can make good his claim that a bidder can be found to build a three-cent road.

The Hanley-Casey Company, of Chicago, has been awarded the contract for constructing the sewers at the grounds of the Louisiana Purchase Exposition. These sewers are to empty their contents into two pump wells from which the sewerage will be raised by four large electric motor-driven pumps and discharged into the city sewers through a two-foot steel pipe 3,650 feet in length. The power for these motors will be furnished by the exposition plant.

The announcement of the results of experiments made by Professor Loeb, of Chicago, in his search for the causes of life and death has created much comment in all quarters of the scientific world. The story of Professor Loeb's discovery is more interesting and in every way as unique as the old story of Faust and Mephistopheles —more interesting because the aged Faust would not, under the operation of the Loeb theory, be obliged to sell his soul to Satan in order to regain the "lost roses of youth." Professor Loeb's idea seems to be that the human body is a sort of electric generator which manufactures electricity from the food which is eaten. According as the negative and positive currents are properly or improperly supplied life is sustained or cut short. So it appears that each day this mysterious unknown, electricity, is shown to be more needful in the world's development. There is a school of theorists who believe that those members of society, commonly called criminals, are in reality an irresponsible class suffering from mental disorders which blunt their faculties and make them unable to distinguish good from evil. If this be true, and Professor Loeb's discoveries are carried to completion, who can say that electricity may not yet, by correcting certain mental and physical ills which men are heir to, eliminate crime and make Utopia not merely a poet's dream but a practical reality?

Mayor Harrison shied his castor in the traction ring in Chicago last week, and in a message which had something of a tabasco flavor, demanded that no hasty action be taken in the matter of granting extension of franchises, but that the people be allowed to express themselves at the polls on this question. Chicago is having barrels of fun over this traction question. Everybody seems to think the present service a poor one, and everybody has a remedy. The traction issue has become a sort of public punching bag, the point being to see who can hit it the greatest number of licks in a given time.

Mr. J. K. Norstrom, of the Globe Automatic Telephone Company, Chicago, is making a tour of several western states looking after some exchanges which his company is installing.

The improvement of the Southwest as a telephone field is generally attracting the attention of telephone manufacturers. The last census gave Texas a population of 3,000,000 and shows a substantial growth in Oklahoma and the Indian Territory. Throughout this section a number of new exchanges have been built and others are being constructed. It is good business, and the manufacturers will carefully look after it to see that it continues to grow.

At 8.30 o'clock on the evening of January 2 Miss Louise Norfleet Black and Mr. Francis Raymond 3d were married in St. Paul's Episcopal Church, Chicago, the Rev. Charles H. Bixby conducting the ceremony. Both Mr. and Mrs. Raymond are popular members of Chicago society. Mr. Raymond is well known and highly esteemed in electric circles.

Patents on Electro-Motive Force Control.

To the Editor of the Electrical Review:

I write to call your attention to four patents which were issued to me on January 7, based upon application of Granville T. Woods. The patents are Nos. 690,807 and 690,809 filed in 1892, and 690,807 and 690,810 filed in 1895. The claims of the patents cover broadly the control of the electro-motive force upon the terminals of a translating device by means of a controllable auxiliary electro-motive force. All modern commercial forms of boosters are subject to the claims of these patents as you will note by reading claim 5 of 690,807, claim 7 of 690,808, claims 1, 2, 10 and 11 of 690,809, and claims 1, 2 and 3 of 690,810.

The claims of these patents also cover the forms of motor control known as the "Teazer System" as you will note by reading such claims as 6, 7, 10 and 11 of 690,809 filed in 1892, which was a great many years before the commercial introduction of the teazer system.

I also call your attention to such claims as 14, 20 and 21 of 690,809 which broadly cover the use of rotary transformer on an electrically propelled vehicle.

The applications for these patents were in interference with the claims of twelve other patent applications while they were in the office, which explains the long interval between their date of application and their date of issue.

So long as these patents belong to me licenses will be granted under them upon moderate terms of royalty to present or prospective users of the patented inventions.

Several of the leading electrical manufacturing companies, such as the Otis Elevator Company and the Crocker-Wheeler Company, have already secured licenses under these patents for certain specific purposes.

H. Ward Leonard.

Bronxville, N. Y., January 10, 1902.

CURRENT ELECTRICAL NEWS

COMMERCIAL NEWS

DOMESTIC AND EXPORT

EUROPEAN CANALS—One of the most important of American commercial enterprises in Europe has just culminated in London, England, in the securing for American interests the right of way for extensive operation throughout European waterways.

MORE TROLLEYS FOR FRANCE—The Compagnie des Tramways a Vapeur de St. Etienne (The St. Etienne Steam Tramway Company), of St. Etienne, France, is reported to be contemplating a change to electric traction. The line has a total length of twenty-eight miles.

A LONG TROLLEY LINE—With the opening of the new line recently between Hartford, Ct., and Springfield, Mass., a system of 135 miles has been completed, connecting Boston, Worcester, Springfield, Hartford and Meriden where there is the first break in the proposed route to New York.

INCREASE OF ELECTRIC LINES IN NEW YORK—According to the annual report of the State Railroad Commission, the length of electric lines in New York state was increased 117.83 miles. Thirty-four new street railway companies were incorporated, with an aggregate length of proposed railroad of 504¾ miles.

THE PACIFIC CABLE—The officers of the Commercial Cable Company and the Commercial Pacific Cable Company have had another hearing before the Senate Naval Affairs Committee. The companies asked that they be not interfered with and that the government should not lay a cable of its own. Forcible opposition to the companies has developed in Washington.

SAN FRANCISCO RAILWAY NEWS—The Baltimore syndicate which has been engaged in a deal for the purpose of acquiring the Market street railway system in San Francisco, Cal., has paid $250,000 as the first tender. This clinches the bargain for the syndicate. The street railway will remain under the present management until the full amount of the purchase price, $17,000,000, has been paid.

ELECTRICAL INCORPORATIONS IN BRITAIN—The more important British limited liability companies connected with the electrical and allied industries that have registered in London during the past year number some forty concerns, representing an aggregate capital of nearly $63,000,000. The largest company as regards capital was the Primitiva Gas and Electric Light Company, Buenos Ayres. The capital of this concern is $6,000,000.

NEW BRITISH TRACTION PROJECT—Many projects for new electric traction systems will come before the British Parliament in the ensuing session. The sum for the construction of these lines is estimated at no less than $225,000,000. The Brighton Electric Company is asking by far the largest sum—$45,000,000 in stock and $15,000,000 in debentures. This is the largest amount of capital, London advices say, ever asked for in any one session.

TWO MILLIONS IN BOND SALE—The Montreal Light, Heat and Power Company has sold $2,500,000 four and one-half per cent bonds to N. W. Harris & Company. This company has $17,000,000 capital stock outstanding. It controls the public lighting of the city of Montreal, both by gas and electricity, and furnishes gas and electricity for domestic and commercial use, for illuminating, heating and power. It also supplies the Montreal Street Railway with power.

CHANGE IN EQUIPMENT—The Illinois Central Railroad will soon have all principal stations along its line equipped with telephones for the use of officials and employés in transmitting the orders and messages of the company. It is expected the telephone will furnish greater safety for train orders, decrease the cost of train operation, and that the constant personal contact between officials and employés will result in better service. The change will cost about $100 a mile, or approximately $540,000 to equip the entire road.

GAS AND ELECTRIC COMPANY OF BERGEN COUNTY—Holders of a large amount of stock of the Gas and Electric Company of Bergen County, N. J., have entered into a stockholders' agreement for the purpose of readjustment of the affairs of the company, and the reorganization of its finances. Edwin Gould, William McKenzie, William Nelson Cromwell, William N. Coler, Jr., David St. John, Richard W. Jones, Addison Ely, William H. Taylor, and John C. Eislee will act as a committee under the agreement, and afford holders of the stock the opportunity of participating in the benefits of the agreement by depositing their stock with the Bowling Green Trust Company, as depositary on or before February 1, 1902.

THE EVERETT-MOORE SITUATION—Decisive action has been taken in the affairs of the Federal Telephone Company, a part of the Everett-Moore Syndicate, when the directors of the parent company, of the United States Telephone Company, the Cuyahoga Telephone Company and the Reserve Construction Company met. Representatives of a number of the heaviest creditors of the Federal company were elected to the directories of the four companies. The new members of the boards of directors are M. Hare, G. Roebling, of Trenton, N. J., of the J. A. Roebling's Sons Company, and J. W. Marsh, vice-president of the Standard Underground Cable Company, of Pittsburgh. They represent themselves and many other creditors. It is probable that a representative of the western creditors will be added to the directorate of these companies within a few days. At a lengthy session of the bankers' committee, it was stated that the trolley situation was very favorable, and ninety per cent of the unsecured creditors has consented to an extension of time.

PERSONAL MENTION

PRESIDENT ERNEST WOODRUFF has retired from the head of the Atlanta Railway & Power Company. Mr. Woodruff is succeeded by Mr. D. A. Belding, of Aurora, Ill. Mr. Belding has been in charge of the street railway properties of Aurora and is said to have been extremely successful in their management.

MR. MAURICE W. THOMAS, formerly connected with the selling department of the Wagner and Bullock Companies, has been put in charge of the apparatus department of the Michigan Electric Company, of Detroit, which handles all varieties of electrical supplies and electric plants.

MR. J. RANDOLPH ANDERSON, of the firm of Mackall & Anderson, attorneys for the Savannah Electric Company, has been in Atlanta, Ga., before the Secretary of State in order to secure the charter for the Savannah Electric Company, the new concern which is to control the electrical interests of Savannah.

MR. CHARLES P. BRUCH, assistant general manager Postal Telegraph Cable Company, New York, is well known in telegraph circles. A splendid half-tone portrait of Mr. Bruch in conjunction with an interesting and expressive foreword appears in the catalogue of the twenty-first annual reunion of the Old-Time Telegraphers' Association held in Montreal, Canada, September 11, 12 and 13, 1901.

LEGAL NOTES

LIABILITY UNDER PURCHASE OF FRANCHISE—A corporation, such as a street railway company, buying the property and franchise of another, not intending consolidation, is held in Capital Traction Company *vs.* Offutt (D. C. App.) 53 L. R. A. 390, not to be responsible for the older company's liabilities.

GUARD RAILS ON OPEN TROLLEY CARS—In a suit for damages against the Staten Island Midland Railroad Company, it is held that the defendant should not be held responsible unless the guard rail was used for specific purpose to keep persons from falling out, and not to prevent boarding or leaving on left side of car.

LIABILITY OF TELEGRAPH AGENT—An agent of a telegraph company in charge of an office at which a message is tendered for transmission is held in Sweet *vs.* Postal Telegraph Cable Company (R. I.) 53 L. R. A. 732, not to be bound to know the time of closing of the terminal office, so as to charge the company with negligence in case the message is received after such office is closed.

RAILWAY COMPANIES TO FENCE RIGHT OF WAY—A statute requiring railroad companies to fence their right of way where the same is contiguous to private property is held in Johnson *vs.* Oregon Short Line Railroad Company (Id.) 53 L. R. A. 744, to be a valid police regulation adopted for the benefit of the general public, and not for the sole benefit of adjoining or contiguous land owners.

ELECTRIC RAILWAYS

FROHNA, MO.—The construction of an electric railway from Frohna to Millersburg is being agitated.

BUFFALO, N. Y.—A new suburban line is planned to take in Java, Wales Center, Elma, Strykerville, Marilla and other villages.

SHARON, PA.—The Penhale-Devitt Syndicate will issue $1,000,000 bonds to build a street-car line between Sharon and Newcastle and make other improvements.

MORRISVILLE, N. Y.—At a recent meeting of the stockholders of the Canastota & Morrisville Railway Company, it was voted to increase the capital stock from $200,000 to $300,000.

TOLEDO, OHIO—Right of way for nearly the entire distance between Fostoria and Toledo has been secured, and grading will soon be commenced. The line between Toledo and Findlay is now completed.

WALTHAM, MASS.—At a special meeting of the aldermen recently a franchise was granted to the Waltham street railway to construct an electric line in Weston, Stowe and Maine streets to the Weston boundary line.

ASHLAND, KY.—The Fiscal Court of Montgomery County has granted the Lexington Electric Railway Company the right of way from Winchester to Mt. Sterling, either over the Winchester or Thompson turnpikes.

MERIDEN, CT.—The Connecticut Railway and Lighting Company is now negotiating for the purchase of the Meriden, Southington & Compounce Tramway Company and it is believed that the deal will go through.

CLEVELAND, OHIO—A bill has been drawn authorizing the city to build or purchase a street railway system. The measure allows the city to issue bonds for not exceeding $50,000 for each mile of single track to be built.

MADISON, WIS.—Clement C. Smith, president of the Columbia Construction Company, of Milwaukee, has begun the preliminary survey of a route for the new interurban electric railway to be built between Madison and Janesville next summer.

SCHENECTADY, N. Y.—The certificate of increase of the capital stock of the Schenectady Railway Company from $300,000 to $600,000, which was decided upon by the stockholders nearly a year ago, has been filed with the Secretary of State.

TIFFIN, OHIO—The Central Ohio Traction Company has taken over the lines of the Tiffin Electric Railway Company and the Toledo & Tiffin Electric Railway Company. It is said that these lines will now be a part of the Everett-Moore Syndicate.

TORRINGTON, CT.—The sectional contracts for the reconstruction of the road-bed of the trolley line running from Torrington to Winsted have been awarded. In this reconstruction the curves are being eliminated as much as possible and the grades reduced.

KANSAS CITY, MO.—Mr. J. J. Heim is interested in the building of an electric line from Kansas City to Topeka. Mr. Heim has been inspecting the railroads of Cleveland, Ohio, for the purpose of securing a more detailed knowledge of the operation of electric railways.

BIRMINGHAM, IOWA—An ordinance granting the Western Construction Company the privilege to operate an electric railway from Burlington to West Burlington is before the city council. The railway is for the purpose of carrying passengers, freight, express and mail matter.

RICHMOND, IND.—The Richmond Street & Interurban Railway Company is planning to build an extension to its lines to Brookville, Ind. The construction of this line will depend upon whether a railway is built to Brookville by the company which is building a line from Harrison, Ohio.

GOSHEN, N. Y.—The Port Jervis electric road was sold by the receiver, Charac J. Van Inwegen, to C. H. Horn and R. E. Beach for $500 above the incumbrances upon it at the time it went into the receiver's hands. The purchasers are the representatives of the interest that secured control of the road last summer.

TRENTON, N. J.—It is understood that the New Brunswick & Trenton trolley line, which will complete the connection between Philadelphia and New York, has found a purchaser for $1,000,000 worth of bonds, which are secured by the same amount of stock, and that the work of construction will be begun at once.

FT. WAYNE, IND.—Two new companies, which are to be known as the Ft. Wayne & Northern and the Ft. Wayne & Southern Traction companies have been organized by the McKinley Electric Railroad Syndicate. It is expected that electric lines will be built from Ft. Wayne to Auburn, Waterloo, Garrett, Hicksville and Decatur.

ANNAPOLIS, MD.—It is expected that the work of constructing a railway to provide rapid transit facilities between Annapolis, Baltimore, Washington and Laurel, will soon be begun by the Washington & Annapolis Electric Railway Company. A large amount of work in securing rights of way, etc., has already been done by the company.

BROOKLYN, N. Y.—The annual meeting of the Brooklyn Rapid Transit Company, held recently, reelected the following board of directors: A. N. Brady, J. L. Greatsinger, A. R. Flower, E. H. Harriman, H. H. Porter, W. G. Oakman, R. Somers Hayes, August Belmont, Henry Seibert, J. G. Jenkins, D. H. Valentine, H. C. Duval and T. S. Williams.

FALMOUTH, MASS.—The directors of the Middleboro, Wareham & Buzzard's Bay Street Railway Company have voted to petition the railroad commissioners for a location in Falmouth for the purpose of extending the railway. An extension from Buzzard's Bay to Falmouth would necessitate the construction of about seventeen miles of track.

TITUSVILLE, PA.—The Titusville Electric Street Railway has just passed into the hands of a company of New York capitalists, who are the promoters of the Crawford County Electric Street Railway Company. W. R. Brown, a New York promoter, financed the transaction, and represents Charles Pfeifer and other capitalists. It is understood that the new company will extend the line to Meadville.

ELECTRIC LIGHTING

PHILADELPHIA, PA.—The International Light, Heat and Power Company has increased its capital stock from $500,000 to $750,000.

POTTSVILLE, PA.—The question of erecting a municipal light plant is soon to be voted upon. It is proposed to devote $15,000 for that purpose.

BERWICK, PA.—The Berwick electric light plant was recently purchased by Robert Adams & Company, who will spend at least $10,000 in improvements.

CLEVELAND, OHIO—Director Dunn is planning to equip the central police station with a lighting plant of its own. He has had estimates on the probable cost.

NEWPORT NEWS, VA.—Consumers' Light, Heat and Ice Company is in difficulty. The G. A. Williams Company, of New Jersey, has filed a supply lien for $82,083.59.

LAKE PROVIDENCE, LA.—Mr. Benjamin Jackson, of Greenville, Miss., has received the contract for the construction of a system of waterworks and electric light plant.

BOURNE CITY, MICH.—A thirty-year franchise has been granted to a company to furnish electric lights. This company has made a contract to furnish the city with street lights.

PRINCETON, WIS.—The contracts for installing an electric light plant have been let by the Citizens' Electric Company, which was recently organized by Mr. F. G. Hebsler, of Ripon.

RIVERSIDE, CAL.—At an adjourned meeting held recently the city trustees voted to purchase more land for the steam power plant in use by the city electric light department.

NEWBERN, N. C.—The electric light bonds which were recently voted upon have been sold to F. M. Stafford & Company, of Chattanooga, Tenn. It is said that the contract for erecting the electric plant will soon be let.

BAKER CITY, ORE.—It is stated that Mr. A. B. Frane will present, at the next meeting of the city council, an application for a franchise for thirty years to use the streets and lights of the city for electric lighting purposes. Mr. Frane proposes at the end of fifteen years to donate three per cent of the gross earnings to the city.

BOSTON, MASS.—The Worcester Consolidated and the Concord, Maynard & Hudson street railways have petitioned the Railroad Commissioners for approval of operating contract; the Boston & Northern Street Railway Company petitions for an increase of $400,000 in capital stock, and the Old Colony a like increase of $100,000.

LA SALLE, ILL.—At a meeting of the directors of the Enterprise Heat, Light and Power Company it was decided to double the capacity of its plant by putting in a new engine and dynamo, and if necessary still another engine and dynamo according to the demand for light and power. The proposition from the Peru-La Salle Gaslight and Power Company to buy the Enterprise plant was rejected by unanimous vote.

ELECTRICAL SECURITIES

Stocks are in good hands and it is evident that big market interests are working for an upward movement. An active market, however, is evidently not receiving much encouragement. It is believed that the larger interests have completed their preparations for a better quotation level. Bond investment is strongly in evidence and in the local bond market trading has been heavy during the week just ended, and evidently representing the investment of January dividends and interest payments.

Indications point toward an easier market. No gold was taken for export. The development of activity in South African mining shares is apparently the forerunner of an end of the Boer war and a resumption of gold shipments from the Rand mines. The local market will be helped by improvement in the foreign markets.

New York banks gained in cash while reserve above legal requirements increased over $6,000,000 to $19,061,450 on January 18. The money market situation should no longer help the bear element. Among the favorable developments of the week were the advance in dividend rate on the New York, Chicago and St. Louis second preferred stock, the public absorption of the $30,000,000 Atchison bond issue and the announcement of valuable "rights" for the New York Central stockholders.

ELECTRICAL SECURITIES FOR WEEK ENDING JANUARY 18.

New York:	Closing.
Brooklyn R. T.	65⅛
Con. Gas	216½
Gen. Elec.	280
Man. El.	136⅜
Met. St. Ry.	164¼
Kings Co. Elec.	180
N. Y. & N. J. Tel. Co.	169
Telep., Tel. & Cbl. Co.	5

Rumors were rife in New York during the past week of a closer union between the New York Central Railway and the Manhattan Elevated. People who have good sources for information think this consummation is not very far distant.

Boston:	Closing.
Am. Telep. & Tel.	159
Edison Elec.	258
Erie Tel.	19¼
New Eng. Tel.	139
Mass. Elec. pf.	92½
Westing. Mfg. pf.	90

The advance in Edison Electric Illuminating Company is receiving attention from financiers. It is evident that ten per cent dividends can be maintained although the real earning capacity has not yet been determined since the merger of the Edison, the Boston and the suburban company some six months ago. The *Boston News Bureau* states that while no increase in the dividend is expected it is believed that the stockholders will continue to benefit through the growth of the company by rights to take in the stock.

Philadelphia:	Closing.
Elec. Co. of America	5½
Philadelphia Elec.	3¼
Union Traction	33½
United G. I. Co.	114
Elec. Stor. Bat. c.	62
Elec. Stor. Bat. pf.	65

The Philadelphia Electric Company, it is announced, will ask for an assessment of $2.50 per share in two payments. This is to cover extensions and the purchase of a suburban company.

Chicago:	Closing.
Central Union Tel.	40
Chicago Edison Light	163
Chicago Telep.	215
Metropolitan El. pf.	90¾
National Carbon	18¼
National Carbon pf.	83
Union Traction	10¼
Union Traction pf.	47

It is announced that a suit has been brought in the Superior Court asking for the appointment of a receiver for the Siemans & Halske Electric Company and to set aside the sale of the company to the General Electric Company, as it is claimed the merger was accomplished without the consent of directors of the Siemans company.

TELEPHONE AND TELEGRAPH

DETROIT, MICH.—The People's Telephone Company has raised enough capital in Cleveland to finish the new telepnone system.

COHOES, N. Y.—The Cohoes & Waterford Home Telephone Company will soon build a new telephone exchange in this city.

WEST SUPERIOR, WIS.—The Bell Telephone Company has set aside $300,000 to be used for improvements at the head of the lakes.

CINCINNATI, OHIO—A two-story brick building, to be devoted entirely to a telephone system, will be built by the Bell Telephone Company at Norwood.

IOWA CITY, IOWA—At a recent annual meeting of the Johnson County Telephone Company the capital stock was increased from $25,000 to $50,000.

DANSVILLE, N. Y.—The village trustees have granted a franchise to the Interocean Telephone and Telegraph Company for the construction of a plant here.

WICHITA, KAN.—The new telephone company has purchased ground on North Market street, and will begin construction immediately. The new system is to cost $100,000.

MUNCIE, IND.—The Home Telephone Company is about to move and enlarge its capacity to 6,000 telephones. It has finished placing a new issue of $55,000 of stock and bonds.

COLUMBUS, GA.—The Southern Bell Telephone and Telegraph Company has made extensive improvements in its long-distance service and subscribers can now talk with New Orleans.

TOLEDO, OHIO—February 1 is the date set for the completion of the new block of the Home Telephone Company, at Fourth and Main streets. Contractor Joseph Pheils says that, barring delays, the building will be finished witnin the contract time.

NEW HAVEN, CT.—Superintendent Baker, of the Southern New England Telephone Company, has made arrangements to consolidate the Derby and Ansonia central stations. Many improvements are in progress, and further work is contemplated.

GREEN BAY, WIS.—Extensive improvements are to be made by the Wisconsin Telephone Company. A new switchboard, which is much larger and more modern than the old one, is being installed. A power plant is also provided in the improvements.

PORTLAND, ME.—The Dirigo Telephone Company, of Maine, has a fine building in Monument Square, Portland. The company is capitalized at $300,000, and by its charter can conduct an independent telephone business throughout the entire state. Mr. L. A. Goudy is the president and general manager.

NEW INCORPORATIONS

WAMPUM, PA.—The Wampum Electric Light Company. $2,000.

TOLEDO, OHIO—The Toledo Electric Railway Company. $200,000.

REYNOLDSVILLE, PA.—Reynoldsville Light and Power Company. $20,000.

FLORA, ILL.—The Flora Light and Water Company. Absorbs the Southern Illinois Electric Light Company.

MURPHYSBORO, ILL.—Murphysboro Waterworks, Electric and Gas Light Company. Capital increased from $80,000 to $160,000.

MILWAUKEE, WIS.—The Wisconsin Light Company. $5,000. Incorporators: H. E. Meyer, A. K. Wheeler and Moses H. Brand.

PEORIA, ILL.—Standard Electric Meter Company. $50,000. Incorporators: J. Henry Blusch, Edward J. Abersol and Arthur Kreisman.

LITCHFIELD, ILL.—The Litchfield Electric Light and Power Company. Change of name to Litchfield Gas and Electric Company, and an increase of capital from $15,000 to $50,000.

JERSEY CITY, N. J.—The Vermont Electric Securities Company, to deal in securities. $1,500,000. Incorporators: August S. Meeker, C. W. Perkins and K. K. McLaren, of Jersey City.

MADISON, WIS.—The Wisconsin Light Company, of Milwaukee, to install plants for public or private lighting. $5,000. Incorporators: H. E. Meyer, A. K. Wheeler and M. H. Brand.

CINCINNATI, OHIO—The Ritter Electric Company. $15,000. To do a general electrical business. Incorporators: William E. Ritter, Joseph Grumsley, Irving A. Ackley, Adelhart Beetz and John N. Ritter.

TRENTON, N. J.—The Ponce Electric Company; $415,000; to operate electric light plants in Porto Rico. The Ponce Railway and Electric Light Company; $50,000; to operate trolleys and electric light plants in Porto Rico.

TRENTON, N. J.—The United States Wireless Message Company. $100,000. For the purpose of wireless transmission of messages and the manufacture of apparatus for the same. Incorporators: Charles Schloeman, Charles M. King, W. M. Green and others, of Jersey City, N. J.

INDUSTRIAL ITEMS

WALSH'S SONS & COMPANY, Newark, N. J., wholesale dealers in scrap iron and metals, get out a pad calendar which is very handy.

THE MCLEOD & HENRY COMPANY, Troy, N. Y., is a manufacturer of boiler door arches and jambs made from a special steel mixture of firebrick.

THE PHOSPHOR-BRONZE SMELTING COMPANY, LIMITED, Philadelphia, Pa., has issued price list No. 29, withdrawing all previous lists. This company manufactures the Delta metal products.

THE ELECTRIC APPLIANCE COMPANY, Chicago, reports that the new type alternating-current Gutmann wattmeter brought so many orders that it has found it hard to keep up with them. It is now in shape to fill orders promptly.

THE TELEPHONE MANUFACTURING COMPANY, of Sumter, S. C., is presenting a beautiful calendar-hanger, in colors, which carries an immediate suggestion of the trade-name ("Imperial") borne by the telephones and switchboards of the company.

THE OHIO ELECTRIC SPECIALTY MANUFACTURING COMPANY—A strong claim for simplicity, durability and economy in trolley ears and high efficiency for its special "T" woven-wire brushes is made by this company. Price list and information upon request.

THE CENTRAL PASSENGER ASSOCIATION has granted an excursion rate of one fare and a third for the round trip to those who will visit Chicago for the automobile show, from March 1 to 8. Information and lists may be had from Samuel A. Miles, manager C. P. A., Chicago, Ill.

THE OHIO ELECTRIC WORKS, of Cleveland, Ohio, has prepared a neat illustrated catalogue of the electric novelties and appliances which it manufactures. In this catalogue are illustrated and described among other things its battery lamps, carriage lights, batteries, motors, etc.

THE SPRAGUE ELECTRIC COMPANY—This well-known electrical company is issuing bulletin No. 208, describing Lundell electric motors, a specialty for hospital service. The company also makes a line of Lundell fans which it claims is especially desirable for hospital purposes.

THE AMERICAN SCHOOL OF CORRESPONDENCE, Boston, Mass.—The trustees of this institution have available a few free scholarships for young men who have been unable to attend technical schools, but who are willing to acquire a substantial training by directed study. Correspondence is invited.

A HANDSOME CALENDAR—The James Kempster Printing Company, New York city, following its usual custom, is placing on the desks of its friends a most attractive and convenient calendar. The figures are pleasing and readable, and the pad is riveted to a substantial red leather base, stamped in gold.

THE INTERNATIONAL ACHESON GRAPHITE COMPANY, Niagara Falls, N. Y., is distributing an artistic booklet full of interesting and instructive reading relative to graphite electrodes. This company makes graphite electrodes for use in electrolytic and electrometallurgical processes, and claims long life, low porosity, high conductivity, and great economy for its product.

THE HAINES & NOYES COMPANY, Chicago, Ill., manufactures the telephone apartment system described in the ELECTRICAL REVIEW of January 4, under Chicago Electrical Notes. This company states that it has installed a large number of these systems in Chicago. St. Louis, Louisville, Kansas City, and in a large number of cities in the East. Full information will be sent on request.

MR. J. W. MASON, formerly traveling salesman in the states of Illinois, Kansas and Missouri, for the Central Electric Company, of Chicago, has recently been appointed to the position of general salesman for the same company, with headquarters at its Chicago office. Mr. Mason is well known to the electrical trade throughout the West, and his many friends will wish him success.

THE SUN ELECTRIC MANUFACTURING COMPANY has recently removed its factories and general offices from Philadelphia to West Chester, Pa. The buildings which it occupies have been designed, erected and equipped in accordance with modern methods for telephone manufacturing. The company is enlarging its lines of telephone instruments, switchboards and accessories, and it purposes to largely increase its output during the coming year.

THE MARINETTE IRON WORKS MANUFACTURING COMPANY, Marinette, Wis., maintains a Chicago office in the Fisher Building. This company manufactures the Walrath gas and gasoline engines, designed for from four to two hundred horse-power. It is said by many engineers that this type of gas engine holds a voltmeter as close as a steam engine, and produces excellent results for commercial electric lighting purposes without the aid of countershafts or heavy flywheels.

THE "TRADESMAN" PUBLISHING COMPANY is distributing the twenty-third annual edition of the "Tradesman." This work sets forth the advantages and resources of the South, and included in the contents are special articles on "The Southern Coal Fields," Woodhead-Graham-Bowron; "The Need of the South for American Ships," M. A. Hanna; "The South from a Northern View Point," J. C. Bayles; "Investments in Southern Forests," C. A. Schenck, Ph. D., and an editorial on "From a Northern View Point."

THE ST. LOUIS ELECTRICAL SUPPLY COMPANY, St. Louis, Mo., is now at work on a new and elaborate catalogue, and it advises us that it will be pleased to have manufacturers of electrical apparatus and electrical devices correspond who are desirous of furnishing cuts or descriptive matter for insertion in this catalogue. It is the intention of the company to make this catalogue a most complete and comprehensive one of electrical and kindred mechanical supplies, and it will be carefully and widely circulated during the coming year.

THE H. W. JOHNS MANUFACTURING COMPANY, of New York, N. Y., and the Manville Covering Company, of Milwaukee, Wis., have been consolidated, and will be known as the H. W. Johns-Manville Company. The capital is $3,000,000. The company is rapidly completing a plant at Milwaukee, Wis., for the manufacture of carbonate of magnesia and mineral wool, and when completed the company will be prepared to furnish a most complete line of steam pipe and boiler covering, and asbestos goods of all descriptions.

THE NEW ENGLAND ELECTRIC COMPANY, Boston, Mass., has recently placed on the market a new fuseless rosette. The chief feature of the rosette is a cord threaded outward through two small holes after having been once carried through the centre hole and is then carried back through the centre hole to the terminal clips. By this means the necessity of tying a knot in the cord for preventing the weight of the lamp from coming on the ends of the cord under the binding screw is obviated. The rosettes are considerably in demand by users of electric lighting apparatus.

THE WESTERN ELECTRICAL SUPPLY COMPANY, St. Louis, Mo., is advising its customers to begin placing contracts for fans, as the success of last year's sale predicts an unprecedented demand. The company states that it has already closed a large number of contracts, and expects to more than duplicate its last year's record, when its factory sold out before the first of June. The company handles the Emerson alternating-current ceiling and desk fans, and the Peerless direct-current fans. The company is sending to the trade a very substantial and practical daily reminder calendar.

SCHLESINGER & MEARS, St. Paul Building, New York, are acting as general sales agents for electrical specialties. They are handling the output of an incandescent lamp factory, and are enabled to offer the "S. & M." incandescent lamp, a high grade lamp, at particularly low prices. Further, any shipment which is unsatisfactory may be returned at their expense. These lamps are made from eight to fifty candle-power, with Edison, T.-H. or Westinghouse base. They are also in a position to make equally interesting propositions on porcelain insulators and cleats, receptacles, rosettes, cutouts and special porcelains.

THE MICHIGAN ELECTRIC COMPANY ENTERTAINS ITS EMPLOYES—The first annual dinner tendered by the Michigan Electric Company to its employés was held recently at the Russel House in Detroit, Mich. It is the intention of the company to cultivate the *esprit de corps* of its numerous employés in as great a degree as possible, and to this end these dinners, it is believed, will prove a feature, while at the same time prizes are offered for suggestions of value to the company in the conduct of its business. The Michigan Electric Company handles the Northern and Stanley apparatus in the state of Michigan, and also does a large business in installing electric light and other plants, and as a general contractor.